REPORT OF THE FORTY-SECOND ANNUAL MEETING OF THE OHIO ACADEMY OF SCIENCE.

WILLIAM H. ALEXANDER,
Secretary.

INTRODUCTORY.

The Forty-second Annual Meeting of THE OHIO ACADEMY OF SCIENCE occurred at the end of April, 1932, in the ample and commodious halls of historic Ohio Wesleyan University in a wholesome academic atmosphere surcharged with a fine spirit of genuine courtesy and sincere cordiality. It seems safe to say that all members of the Academy who were fortunate enough to attend this meeting came away with more than formal words of appreciation on their lips, rather with a stronger affection and greater admiration for old Wesleyan in their hearts.

One hundred and seventy-two members of the Academy and seventy-six visitors registered. Miss Grace and Miss Lucile Lambert looked after the registration in a most gracious and efficient manner.

The local executive committee, under the fine leadership of Prof. Claude E. O'Neal, certainly did all in its power to anticipate and provide for the requirements of the general and sectional meetings and to see that the visitors were properly and amply cared for in their every need, the lady members and visitors being especially honored by the University Women's Club with a tea on Friday afternoon at Stuyvesant Hall.

Two interesting field trips were arranged for, one for the Geological Section and one for the Zoological Section, the former visiting the Devonian limestone locations in the vicinity of Delaware and the latter the heronry located about ten miles north of the city.

The presence of a considerable number of members of the Central Ohio Physics Club and the Akron Physics Club is noted with much pleasure and their helpful co-operation acknowledged with appreciation.

The Annual Dinner was a notable success, the attendance being surprisingly large, in fact, overtaxed the accommodations and some had to be turned away. A warning for next year! Dr. Edward L. Rice acted as toastmaster and introduced

the various speakers in his usual happy manner. Following a most appetizing dinner delightfully served with the assistance of Ohio Wesleyan's fair students, Dean Smyser was introduced and added his gracious words of welcome to the written message of President Soper (necessarily absent from the city) to which President Smith replied on behalf of the Academy. The greetings being over, President Alpheus W. Smith was then presented and gave the Presidential Address on "Physics and Human Experience," much to the pleasure and profit of all who heard him.

MINUTES OF THE BUSINESS MEETINGS.

First Session: April 29, 1932.

The first business session of the Forty-second Annual Meeting of the Ohio Academy of Science was called to order by President Smith in the Chapel Annex, University Hall, at 9:41 a. m., with a quorum present.

The President announced the following committee appointments:

Committee on Membership—George D. Hubbard and Allen C. Conger.

Committee on Resolutions—Miss E. Lucy Braun, E. H. Johnson and Paris B. Stockdale.

Committee on Necrology—Walter H. Bucher and Walter C. Kraatz.

The reports of the Secretary and the Treasurer were then read, the former was accepted and ordered filed and the latter was referred to the Auditing Committee. Both reports are published in these proceedings.

After the reading of the Treasurer's report and at his suggestion, the following motion was made and unanimously passed:

That the question of Academy accounting system and custody of funds be referred to the Executive Committee with power to make desirable adjustments, and if necessary to recommend amendments to the Constitution and By-Laws, and

That this motion be notice of such amendments to the Constitution and By-Laws as may be necessary in the paragraphs or sections concerning custody of funds and accounting system

The President then called for the election by the Academy of an Auditing Committee, whereupon M. E. Stickney, of

Denison University, Granville, and E. H. Johnson, of Kenyon College, Gambier, were placed in nomination and upon motion, duly passed, the Secretary was instructed to cast the unanimous ballot of the Academy for the persons nominated, which he did and they were declared elected.

The election by ballot of a Nominating Committee was called for and following the precedent of last year, upon motion duly made, seconded and passed, the Secretary was instructed to cast a written ballot for the present seven vice-presidents of the Academy to serve as a Nominating Committee to report at the annual meeting in 1933. The Secretary cast the written ballot of the Academy accordingly and the following persons were declared elected to serve as the Nominating Committee for 1933:

Zoology: DWIGHT M. DELONG, Ohio State University.
Botany: ARTHUR T. EVANS, Miami University.
Geology: E. M. SPIEKER, Ohio State University.
Medical Sciences: SHIRO TASHIRO, University of Cincinnati.
Psychology: HORACE B. ENGLISH, Ohio State University.
Physical Sciences: FORREST G. TUCKER, Oberlin College.
Geography: EUGENE VAN CLEEF, Ohio State University.

The President asked Mr. Dwight M. DeLong to act as temporary chairman of the committee until a permanent organization could be effected.

At this point, it was suggested by the Secretary that in as much as the hour had arrived (10:00 A. M.) for the general scientific session, that the business session take a recess until after the scientific session. This was agreed to and at 10:10 A. M. Mr. O. N. Liming, of the Ohio Agricultural Experiment Station, was introduced and discussed "The Dutch Elm Disease in Ohio" in a very informing manner and closed with an appeal for a general co-operation in the study and location of the disease in Ohio during the current year, as this work by the Experiment Station was seriously handicapped for lack of funds.

The President then advised the Academy that owing to serious illness in the family, Mr. Julius F. Stone, much to his regret, could not be present and give his address on the Mayan Civilization of Central America as announced.

Mr. N. E. Oltman, a student at Oberlin College, introduced by Prof. F. O. Grover, was given an opportunity to describe

to the Academy an instrument of his invention for the accurate quantitative determination of chlorophyll.

The next item on the scientific program was a moving picture showing "The Treatment of Osteomyelitis with Blowfly Larvae," presented and discussed by Dr. D. F. Miller and Dr. E. H. Wilson, of Ohio State University. This was an outstanding and most informing feature of the program and greatly enjoyed by all who saw and heard.

At 11:00 A. M. the business session was resumed. The Secretary read the report of the Executive Committee and under new business the several recommendations contained in the report of the Executive Committee were considered and all approved except the one as to place of meeting for 1933; this together with the time of meeting and the selection of representatives on the Council of the American Association for the Advancement of Science, the State Academies Conference of the A. A. A. S. and the Save Outdoor Ohio Council were referred to the Executive Committee with power.

Regarding recommendation numbered 3 (the omission of the membership list from the Proceedings), the Secretary pointed out that this would require an amendment to the By-Laws (Chapter VI, Section 4). Upon motion duly passed by a majority of those voting it was agreed that the By-Laws be amended so as to require the publication of the membership list at five-year intervals.

The report of the Trustees of the Research Fund was read by the chairman, Dr. Herbert Osborn, and referred to the Auditing Committee.

At 12:10 P. M. the business session was adjourned until 9:00 A. M. Saturday, April 30, 1932.

Second Session: Saturday, April 30, 1932.

The Academy was called to order by the President at 9:10 A. M. with a quorum present.

The first item of business at this session was the reading of the report of the Library Committee by its chairman, Mrs. Ethel M. Miller. This report was obviously enjoyed and appreciated by the Academy and was referred to the Auditing Committee.

The report of the Committee on State Parks and Conservation was read by the chairman, Dr. Herbert Osborn. Following

the reading of this report, Doctor Osborn proposed and the Academy adopted the following resolutions:

1. That we favor the passage of H. R. Bill No. 6478 and substitute Senate Bill No. 1704 to provide for Water Conservation Survey in Ohio.
2. That we favor extension of Water Conservation program.
3. That we especially commend the programs of education in conservation and preservation of wild flowers as outlined by the Wild Flower Preservation Society and the Central Ohio Anglers' and Hunters' Club.
4. That we favor the setting apart of suitable areas in State Parks as wild life sanctuaries to be free from disturbance of natural conditions and not open to picnic or camping parties, or to provision of roadways or paths.
5. That we favor legislation to protect hawks and owls except to the right of any citizen to control them when in the act of destroying property, and that the use of pole traps be made illegal.

Reports of special committees were now called for and presented in the following order:

Committee on the Election of Fellows, by the Secretary.
Committee on Membership, by Geo. D. Hubbard.
Committee on Necrology (informal by the President; committee asked to submit a full report later to the Secretary).
Committee on Auditing, by M. E. Stickney.
Committee on Junior Scientific Effort in Ohio, by C. G. Shatzer.
Committee on the Academy's Relation to the Ohio Journal of Science, by E. L. Rice.
Committee on Publications, by F. O. Grover.
Committee on Administrative Board, by E. L. Rice.
Committee on Nominations and Election of Officers, by W. J. Kostir.
Committee on Resolutions, by E. H. Johnson.

The above reports will be found published in full elsewhere in these Proceedings.

Under the head of unfinished business two motions were made and passed:

(1) That Dr. Herbert Osborn and Prof. James A. Nelson be the duly appointed delegates of the Academy to the Fifth International Congress of Entomologists at Paris, France.

(2) That the question raised by the chairman of the Library Committee as to whether the funds received from the sale of the Proceedings should be credited to the Academy or to the Journal be referred to the Executive Committee.

Adjourned *sine die*, 10:55 A. M.

REPORTS.

Report of the Secretary.

DELAWARE, OHIO, April 29, 1932.

To the Ohio Academy of Science:

Again, briefly!

Of course, the first serious task of the secretary following an annual meeting is to see that the proceedings of the meeting are promptly put into shape for the Publications Committee and the printer, not forgetting the Editor of the OHIO JOURNAL OF SCIENCE. And this is no small task, be assured, now that we include in addition to the usual *minutes* and *reports* a very considerable number of *abstracts*. The secretary freely admits that he is *deliberately*, and perhaps with some degree of "malice aforethought," seeking to unload much of the work of collecting and editing the abstracts on to the shoulders of the unsuspecting (?) vice-presidents! And he is glad to report, *with appreciation*, that he is succeeding grandly thus far!

As you probably know, the proceedings of the Oxford Meeting were published as the July issue of the OHIO JOURNAL OF SCIENCE (Number 4, Volume XXXI) under the new plan of publication of that journal.

A report of the Oxford meeting was also prepared for and published in *Science*.

Certificates of election were prepared and sent to all those elected to fellowship at the Oxford meeting.

A new form on which to nominate members to fellowship in the Academy was prepared, printed and distributed upon request, as requested by the Committee on the Election of Fellows at the Oxford meeting.

Routine matters of varying degrees of importance required considerable time and attention from the closing up of the work of the annual meeting of last year and the beginning of negotiations for the ensuing annual meeting—seemingly a very short time! The details were taken care of as promptly and as efficiently as possible under the existing, living conditions of the Secretary.

Of course an enumeration of these minor details is neither necessary nor wanted, but there is one accomplishment of the year in which the Secretary had a very pleasing though minor part which is of sufficient general interest, it is believed, to warrant mention at this time, namely, the organization of a new section, the *Section of Geography*. Some twenty persons (see following) expressed an interest in such a section and judging from the initial program offered at this meeting it is a rather lusty infant and is sure to be heard from in the future.

Finally, Mr. President and fellow officers and members of the Academy, permit the Secretary to record and express his very high appreciation of your unfailing patience, courtesy and co-operation during the year now ended.

Respectfully submitted,

WILLIAM H. ALEXANDER,
Secretary.

Supplemental

A list of persons who signified an interest in a Section of Geography within the Ohio Academy of Science.

C. G. SHATZER, Wittenberg College.
W. A. P. GRAHAM, Ohio State University.
*W. R. MCCONNELL, Miami University.
FRANK J. WRIGHT, Denison University.
CARL VARVEL, Ohio State University.
WILBUR STOUT, Ohio Geological Survey.
PARIS B. STOCKDALE, Ohio State University.
RODERICK PEATTIE, Ohio State University.
*C. E. COOPER, Ohio University.
A. J. WRIGHT, Ohio State University.
*W. M. GREGORY, Western Reserve University.
CARL VER STEEG, Wooster College.
*L. B. KARNES, Ohio State University.
EUGENE VAN CLEEF, Ohio State University.
A. E. WALLER, Ohio State University.
FRED CARLSON, Ohio State University.
E. N. TRANSEAU, Ohio State University.
G. H. SMITH, Ohio State University.
C. C. HUNTINGTON, Ohio State University.
CLARENCE KENNEDY, Ohio State University.

Report of the Executive Committee.

DELAWARE, OHIO, April 29, 1932.

To the Ohio Academy of Science:

The Executive Committee has met four times during the year, three times as an *executive committee* and once in joint session with the vice-presidents as a Committee on the Election of Fellows.

At the first of these meetings, held in the office of the secretary on December 12, 1931, Dr. Herbert Osborn, editor of the OHIO JOURNAL OF SCIENCE, was present by invitation and joined in the deliberations of the committee. The following items of business of general interest to the Academy were presented, discussed and agreed to, viz.:

1. That the treasurer be authorized to pay the sum of three hundred dollars ($300.00) toward the printing of the Proceedings of the Oxford meeting (the Forty-first Annual Meeting).
2. That the Publications Committee be requested to limit all abstracts to 200 words.
3. That it is the sense of the Committee that the publication of the membership list should hereafter be omitted from the published Proceedings (except as ordered by the Executive Committee) and that a mimeographed list be supplied to officers of the Academy.
4. That a *Section of Geography*, with Dr. Eugene Van Cleef as the provisional vice-president, be authorized, subject to the final approval of the Academy. This action was based on the expressed interest in such a section of the following persons: (See attached list).

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*Non-members.

5. That the applications for membership in the Academy of the following six persons presented by the secretary be approved and recommended to the Academy: Dr. Stanley A. Cain, Fred S. Darling, Ralph H. Davidson, Vincent R. Peterson, Winford L. Sharp and Charles W. Super (90 years old).

6. That Dr. Herbert Osborn and Dr. A. E. Waller be the Academy representatives on the Save Outdoor Ohio Council.

7. That Dr. Herbert Osborn be the Academy representative on the Council of the A. A. A. S. and the State Academies Conference of the A. A. A. S. at the New Orleans, La., meeting.

8. That the annual meeting for 1932 be held during the Easter holidays, or spring vacation, as may best suit the entertaining institution, the place to be decided upon later, after necessary negotiations by the secretary. (Needless to say it was later decided to accept the invitation of Ohio Wesleyan University.)

9. That the action of President Smith in appointing Professors E. L. Rice and C. G. Shatzer on the Administrative Board of Ohio Journal of Science and of Professor E. L. Rice as chairman of the Special Committee on the Relations of the Ohio Academy of Science and the Ohio Journal of Science, in securing the approval of a majority of the committee to the working plan on the relations of the Ohio Academy of Science to the Ohio Journal of Science be approved.

10. That the new form prepared by the secretary on which to nominate fellows be approved.

At the second meeting of the committee held on March 19, 1932, in the office of the secretary, the applications for membership of fourteen persons were submitted by the secretary and approved subject to ratification by the Academy. The names are included in the list submitted herewith.

The action of the secretary in appointing Prof. Dwight M. DeLong, of Ohio State University, as vice-president of the Section of Zoology, vice J. Paul Visscher, resigned, was approved.

The details of the general program of this (Delaware) meeting were considered at length, agreed upon and recommended to the Program Committee about as they appear in the printed program before you.

The third meeting of this committee was held last evening in joint session with the vice-presidents as a Committee on the Election of Fellows and the actions taken at this meeting will appear in another report.

The fourth and last meeting of the committee was held last evening following the adjournment of the joint session just mentioned and the following items of business were transacted:

(1) Upon the request of Prof. E. L. Rice, Prof. August F. Foerste was appointed to assist in the completion of the audit of the Treasurer's report of 1930–1931, instead of Prof. J. E. Hyde, absent on account of illness.

(2) That the Executive Committee recommend the acceptance of the very cordial (second) invitation of Ohio University, Athens, through its President, to hold the annual meeting of 1933 at that institution.

(3) The final report of the Auditing Committee on the Treasurer's report of 1930–1931 was received, accepted and ordered filed. See page 274.

Respectfully submitted,

WILLIAM H. ALEXANDER,
Secretary.

Final Report of the Auditing Committee.

(For the Year 1930–1931)

April 28, 1932.

To the Executive Committee, Ohio Academy of Science.

GENTLEMEN:—The audit of the Treasurer's accounts for 1930–31 was left incomplete, owing to the absence of certain data deemed necessary by the Auditing Committee, Messrs. Hyde (chairman) and Rice. A final report was to be presented to the Executive Committee; but, owing to the illness of the Chairman, this has not been done.

At the request of Mr. Rice, Mr. Foerste was requested by the Executive Committee to co-operate in the completion of the audit.

The lacking data have been examined, especially a statement concerning the invested funds, and we hereby report the accounts as found correct in substance.

We wish to suggest, however, that the form of the accounts is not satisfactory, and to express our judgment that the Executive Committee should consider the advisability of employing a trained accountant to set up a simple form of bookkeeping for the assistance of the Treasurer.

We wish further to suggest that it is very desirable to arrange (with change of by-laws or constitution if necessary) for the audit of the Treasurer's accounts prior to the time of the Annual Meeting, when the auditors can work carefully and thoughtfully. This work might well be done by a trained accountant rather than by a committee of members of the Academy; in fact it is a fair question whether the time has not come when the entire accounting of the Academy, including that of the Research Fund, should be put in professional hands.

AUG. F. FOERSTE,
EDWARD L. RICE,
Committee.

MEMORANDUM.

Letters from the Treasurer and the Secretary under dates of April 22 and 23, 1932, examined and appended, as furnishing the necessary additional data.

EDWARD L. RICE.

Report of the Treasurer.

(For the Year 1930–1931.)

RECEIPTS.

Cash balance on hand April 14, 1930	$1,614.32
Receipts from sale of publications	76.75
Dues from members, back dues collected	1,282.48
Received from A. A. A. S.	120.00
Two Life Memberships in the Academy	100.00
Total Receipts, Exhibit A	$3,193.55

DISBURSEMENTS.

L. H. Tiffany, expenses as chairman of the Botany Section, 1930	$ 4.47
W. H. Alexander, Secretary's Honorarium	100.00
A. H. Peterson, Chairman, Local Committee, for 1930 meeting	19.00
C. E. Wilson, posters for 1930 meeting	6.00
University Press, Academy dinner tickets for 1930	1.95
Martin L. Reymert, expenses as chairman of Psychology Section, 1930	14.05
C. E. Wilson, signs, wood frames and sticks	10.00
University Press, maps of campus for 1930 meeting	2.60
Spahr and Glenn, addressed return envelopes	2.50
Spahr and Glenn, Proceedings of Thirty-ninth Annual Meeting	355.50
O. S. U., flowers for Academy dinner	10.00
Rose McCabe, secretarial services for Treasurer	29.00
Spahr and Glenn, for 1,000 copies of Proceedings of the Fortieth Annual Meeting	370.50
Spahr and Glenn, for letterheads and binding Volume 7	16.50
W. H. Alexander, Secretary, for postage	30.96
Save Outdoor Ohio League, two memberships	24.00
P. B. Stockdale, expenses in connection with surveying for field trip of Geology Section	31.80
B. S. Meyer, Business Manager, Ohio Journal of Science, for 480 members of the Ohio Academy of Science	720.00
Columbus Postmaster, 1,000 stamped envelopes	22.16
F. C. Waite, railroad fare for attendance at two executive meetings	24.08
James P. Porter, transportation expenses to executive meeting	5.44
C. G. Rogers, transportation expenses to executive meeting	7.32
J. H. Hoskins, transportation expenses to executive meeting	5.00
Spahr and Glenn, for preliminary announcements, post cards, etc	27.25
Spahr and Glenn, for statements and envelopes	6.75
J. H. Hoskins, for work on program committee	7.80
C. G. Rogers, for work on program committee	7.32
Columbus Postmaster, for stamps for circularizing members of the A. A. A. S. (700 1½-cent stamps)	11.25
Check returned	2.50
Total Disbursements, Exhibit B	$1,875.70
Receipts	$3,193.55
Disbursements	1,875.70
Cash balance on hand March 30, 1931	$1,317.85

The review of the financial transactions of the Ohio Academy of Science is more than an accounting for received and spent. It presents a concise picture of the activities and growth of the Academy. In spite of drouth, depressions in agriculture and in the business world, it is still possible to present a report of increasing interest in the work of the Academy.

The total number of paid up members for the current year is 480 as compared with 371 for the previous year, an increase of 109 members. This can be accounted for in part by an increase in the number of high school teachers and graduate students who have in the past year become members of the Academy. In spite of the reiteration of its aims to include all persons interested in Science who wish to become members of the Academy, the officers continually find persons who express surprise that membership in the Academy is not a matter of special invitation. We have a membership committee that functions definitely at our meetings. The executive committee has not succeeded in developing

a mechanism whereby prospective members may be canvassed throughout the year. Will the reader of this report therefore aid the Academy by personally canvassing and proposing one new member. Two attempts have been made by the Treasurer to advertise the Academy. At the 1930 Educational Conference held at Ohio State University, the advantages of the Academy were explained in meetings of the Physical and Biological conferences and a table was provided in connection with biological demonstrations, at which was displayed the volumes of the Ohio Journal of Science and the Proceedings of the Academy. During the past week a circular letter was mailed to all members of the A. A. A. S. in Ohio who are not members of the Academy. Both methods have resulted in the addition of enough members to warrant continuation.

The other sources of income for the Academy are the sale of publications, details of which are reported by the Academy Librarian, and the allowance made to the Academy from the A. A. A. S.

Two memberships in the Save Outdoor Ohio League appearing this year are tangible evidence of the Academy's interest in a field where it has long been the pioneer and even the only organization devoted to the protection of natural resources and wild life.

Respectfully submitted,

A. E. WALLER,
Treasurer.

TREASURER'S LETTER.

COLUMBUS, OHIO, April 22, 1932.

To the Auditing and Executive Committees, The Ohio Academy of Science.

GENTLEMEN:—The absence of two cancelled checks temporarily misplaced by the bank last year at the time of filing the report of the treasurer at the annual meeting caused a good deal of worry. These checks later came to light and are available for examination by the auditing committee. At the time of the meeting last year the arrangement was made for the auditing committee to meet with the executive committee and present its report. To my knowledge this has not been done. The situation has both a serious and an amusing aspect if the committee cannot file a report without the check, especially since they appear on the bank's statement, but the treasurer found little humorous relief in the situation.

At the same time a more important thing was brought up, namely, that of a complete résumé of the financial reports beginning before the present treasurer's accession to office. Let it be stated that the treasurer never sought the responsibility of looking after the Academy's funds and has tendered his resignation annually because of a feeling of inadequacy in bookkeeping. The reports show that expenditures and income have tallied, but failed to show the source of all the items of income in a satisfactory manner. The treasurer was given some suggestions which have been put into effect. If, however, a more elaborate system of bookkeeping is desired the treasurer would have to ask for assistance in making and keeping the records. The time at his disposal does not permit any but the simplest arrangements for collecting and recording the dues, etc.

The solidarity of the Academy's financial position is attested by the accumulation of a substantial reserve fund all at present in United States Government Bonds. This type of investment was chosen at the discretion of the Treasurer several years ago after the original purchase of a Building and Loan certificate. The return from the government bonds is not high, but the measure of safety has certainly justified the investment. These bonds being Liberty Bonds will possibly be called for retirement before the close of the year as the government expects to refinance with bonds at a lower interest rate. Since the turn of the investment is a necessity, it might be wise for the Executive Committee to inquire about reinvest-

ing our fund in substantial common stocks, or in a British type Investment Trust, or in high grade Municipal bonds. The reserve fund may have to be drawn on slightly to meet current expenses, but there should still be around $1,500.00 available at the present time for permanent investment.

Respectfully submitted,

A. E. WALLER, *Treasurer.*

SECRETARY'S LETTER.

COLUMBUS, OHIO, April 23, 1932.

To the Auditing and Executive Committees, Ohio Academy of Science.

GENTLEMEN:—In connection with the Treasurer's letter of the 22nd instant, permit the undersigned to say that he in company with the Treasurer this day visited the Safety Deposit Vaults of the Huntington Bank Building and inspected the bonds now on deposit in the Ohio Academy of Science safety deposit box. We found there six (6) Fifty Dollar U. S. Bonds and fourteen (14) One Hundred Dollar Bonds with coupons attached, or a total of $1,700.00 in interest bearing U. S. Bonds.

The two cancelled checks, one for $7.80 in favor of J. Hobart Hoskins, and the other for $11.25 in favor of James R. Geren, Postmaster, Columbus, Ohio, referred to in the Treasurer's letter, are being forwarded this date to the chairman of the Auditing Committee, Prof. E. L. Rice, Delaware, Ohio. It would seem this matter can now be completely and promptly cleared up and all minds put at ease.

Furthermore we think it only fair to suggest that the existence of an available fund of $1,700.00 accumulated since the present Treasurer came into office is proof positive that the financial interests of the Academy have been in safe hands and the financial policies followed obviously wise and sound. The Academy should know this.

Cordially,

WM. H. ALEXANDER, *Secretary.*

Report of the Treasurer.

(For the Year 1931-1932.)

DELAWARE, OHIO, April 28, 1932.

To the Executive Committee, Ohio Academy of Science.

GENTLEMEN:—Each year your treasurer has been able to report the sound financial condition of the Academy. Each year he has offered suggestions for uses to be made of the Academy's funds. During this time he has had the pleasure of seeing the reserve funds increase, but at no time has any particular action been taken on his suggestions. While the size of the Academy has increased during the period of his treasurership the expenses of its operation have been held to a low figure and each item of expenditure carefully checked. Looking over the record of expenses, by far the largest item is for printing, both in the form of subscriptions to the Ohio Journal of Science and the Proceedings of the Academy, its programs, notices and announcements. This is as it should be. At least, it should until the Academy can some day look forward to having a home of its own with library and museum facilities, activities on an entirely different scale from any as yet modestly foreshadowed in our Academy, but already in existence in certain more fortunately endowed scientific societies. It is with the future uses in mind that the Treasurer has been accumulating a surplus fund out of current income that will make a small beginning for the Academy of the future.

However, the responsibility for looking after this fund should not be entirely in the hands of the Treasurer, but the Executive Committee should devise a way to supervise it. Similarly the Research Fund, nominally in the hands of the Treasurer, but actually not administered by him, should be so treated. It would be desirable if the Academy would hold a business meeting apart from those connected with the annual meeting or in preparation for it. Probably it would be desirable for the Academy to have a certified Accountant set up a system whereby the several funds of the Academy could be managed in the simplest possible manner.

It is quite obvious to all of us that the accumulation of unexpended reserves or the accumulation of life memberships will never permit the Academy to increase its capital resources at a very great rate. It has occurred to the Treasurer that we might attempt to interest some of the members and their friends in aiding the Academy by money gifts. Perhaps this sounds optimistic at this period of financial change, but it is in just such times that a newer and often better concept of money values is likely to appear. One method of accumulating money that would spread the cost to the donor over a number of years would be by purchase of life insurance policies with the Academy as beneficiary. It is just because we have a small start toward a fund that I believe we can go to our members and ask for aid.

Respectfully submitted,

A. E. WALLER,
Treasurer.

TREASURER'S REPORT.

RECEIPTS.

Cash balance on hand March 30, 1931	$1,317.85
Receipts from sale of publications	135.00
Received from A. A. A. S.	141.00
Dues from members, back dues collected	1,445.00
Interest from Bonds	58.38
Refund on check for bonds	80.31
Total Receipts, Exhibit A	$3,177.54

DISBURSEMENTS.

James P. Porter, expenses for Program Committee for 1931 meeting	$ 5.44
L. W. Taylor, expenses for Program Committee for the 1931 meeting	8.52
Irona Smith, mimeographing letters to A. A. A. S. members, 1931	5.00
Rose McCabe, clerical help, sending letters to A. A. A. S. members	5.50
Frank J. Wright, expenses for Program Committee for 1931 meeting	3.60
Huntington National Bank, safety deposit box for 1931	3.00
O. S. U. General Storeroom, envelopes, cards, etc	2.23
Spahr and Glenn, for stationery	12.00
W. J. Kostir, expenses for Vice-President of Zoology Section for 1931 meeting	8.40
W. H. Alexander, Secretary's Honorarium	100.00
W. H. Alexander, clerical help, telephone calls, telegrams, etc	34.50
Frank J. Wright, expenses for Vice-President, Geology Section for 1931	12.00
Check returned	2.50
Banco Ohio, U. S. Treasury Bonds	857.86
Check returned	7.50
Spahr and Glenn, for printing programs	101.66

Save Outdoor Ohio Council, two memberships	24.00
Bernard S. Meyer, Ohio Journal of Science, for 505 members in the Academy for 1931 at $1.50 each	757.50
James P. Porter, expenses for Psychology Section for 1931 meeting	15.00
August Foerste, expenses attending Executive Committee meeting, 1931	2.25
Columbus Postmaster, 1,000 stamped envelopes	22.16
B. S. Meyer, Business Manager, Ohio Journal of Science, for Proceedings	300.00
Check returned	2.50
Irona Smith, mimeographing letter regarding dues	2.00
Spahr and Glenn, for 600 postal cards regarding 1931 meeting, and 200 application for membership blanks	16.50
Spahr and Glenn, for Preliminary Program for 1931	12.00
Roof Stenographic Service, envelopes and postage on preliminary announcements for 1931 meeting	22.53
Spahr and Glenn, Fellowship blanks, statements and envelopes	12.25
W. H. Alexander, postage, long distance calls, envelopes	14.20
August Foerste, expenses for Executive Committee meeting for 1931	2.25
Huntington National Bank, for safety deposit box for 1932	3.00
Rose McCabe, secretarial services for Treasurer from April, 1931, to April, 1932	27.50
Herbert Osborn, for Research Fund	100.00
B. S. Meyer, Ohio Journal of Science, for 300 members in the Academy for 1932 at $1.50 each	450.00
Total Disbursements, Exhibit B	$2,955.35
Receipts	$3,177.54
Disbursements	2,955.35
Cash balance on hand April 25, 1932	$ 222.19

Report of the Auditing Committee.

DELAWARE, OHIO, April 29, 1932.

To the Ohio Academy of Science:

We have examined the Treasurer's Report to the Ohio Academy of Science for April 28, 1932, together with all cancelled checks and the statement of all deposits with the Huntington National Bank of Columbus, Ohio, and find the report correct.

Respectfully submitted,

M. E. STICKNEY,
E. H. JOHNSON,
Auditing Committee.

Report of the Trustees of the Research Fund.

DELAWARE, OHIO, April 29, 1932.

To the Ohio Academy of Science:

During the past year no grants to individuals have been made as it seemed desirable to hold the funds available for possible readjustments or contingencies in investment. The following summary of the account for 1931–32 shows an invested fund of $1,737.50 and a balance in uninvested account subject to check of $137.80.

SUMMARY OF ACCOUNT, 1931-32.

RECEIPTS.

Balance from checking account, April 1, 1931	$ 150.86
Interest receipts from invested funds	25.00
Life memberships	100.00
Total	$ 275.86

EXPENDITURES.

By transfer to invested fund	$ 137.50
Bank service charge	.50
Balance in checking account	137.86
	$ 275.86

SUMMARY OF ASSETS.

Invested Funds, Bonds and Stock Certificates	$1,737.50
	137.86
Total	$1,875.36

Interest payments on bonds held were temporarily suspended, but have been restored on a reduced interest basis with new bonds, and officers of the Ohio National Bank are confident that the bonds are fully secured and that there is hope that the back interest will be paid.

Respectfully submitted,

(Signed) HERBERT OSBORN,
L. B. WALTON,
G. D. HUBBARD,
Trustees.

Report of the Auditing Committee.

DELAWARE, OHIO, April 30, 1932.

To the Ohio Academy of Science:

We have examined the report of the Treasurer of the Research Fund together with all bank statements and find the report correct.

M. E. STICKNEY,
E. H. JOHNSON,
Auditing Committee.

A Supplemental Report by the Trustees of the Research Fund.

With the growth of the Research Fund it seems desirable to clarify certain provisions of the Constitution and By-Laws which seem to have been overlooked in the handling of Research Funds.

The Trustees of the Research Fund were originally elected at the eighth annual meeting, December, 1898, when it was announced by Professor Lazenby that "Emerson E. McMillin had offered $250 to the Trustees of the Academy * * *," and an amendment to Article of the Constitution was proposed, and subsequently adopted at the annual meeting in 1899, reading, "There shall be a Board of Trustees consisting of three members; one elected for one year, one for two

years, and one for three years. It shall be the duty of this Board of Trustees to act as custodians of all property of the Academy and to administer all funds received for original investigation and research."

While later action provided for care of other properties, the Research Fund has remained continuously in charge of the Trustees of the Research Fund, and it appears that in later amendments of the Constitution and By-Laws this condition was overlooked.

Thus in the revised Constitution and By-Laws adopted November 28, 1908, and further amended in 1920, it is specified, Article 4, Section 11: "The Treasurer shall have custody of all funds of the Academy."

Article 4, Section 14: "The Trustees of the Research Fund shall be three in number. They shall have charge of the allotment and distribution of the income or of the principal of the Research Fund."

In references to Life Memberships, By-Laws, Chapter 1, Section 2, "The sums paid in commutation of dues shall be invested, and the interest used for the ordinary purposes of the Academy during the payer's life, but after his death the sum shall be converted into the Research Fund."

The custom of Research Funds being received and handled by the Trustees, which prevailed at the start was evidently continued without question after the adoption of the statement of duties of the Treasurer and might be interpreted to mean that these funds were not counted as current Academy funds that should be in his hands. It was the case at time of death of Dr. Mendenhall, while he was chairman of the Trustees, and after which his accounts came into the hands of the present chairman.

Also, it has been the custom and I think the general understanding that life memberships are added to the research fund though the amended statement seems to intend otherwise.

We recommend, therefore, that the Trustees with the Executive Committee (of which the Treasurer is a member) be authorized to interpret these apparently contradictory clauses and if deemed necessary to recast the paragraphs to make their observance harmonious.

If it is desired that the Trustees be responsible for custody as well as administration of Research funds, it will be necessary only to amend Article 4, Section 11 by insertion of "except funds in charge of Trustees of the Research Fund." If desired that the Treasurer, who is under bond to amount of $500, have this duty, an order for transfer and provision for maintenance of separate account is needed. Also decision as to disposition of Life memberships is desirable. The constitution does not specify "life members," but the provision for commutation of dues is the basis for use of this term.

Report of the Library Committee.

COLUMBUS, OHIO, April 28, 1932.

To the Ohio Academy of Science:

The Library Committee presents the following report:

The members of this committee have considered several matters during the year both by letters and in conferences.

The work of the chairman has been largely routine and has consisted of changing addresses for the mailing list, posting separate issues to members and exchanges, requesting exchange publications that had failed to arrive, and correspondence on various matters. The members of the Academy have been unusually careful about supplying correct addresses this year, so that the mailing list seems to be in a very satisfactory condition at the present time.

In accordance with the decision made last year not to publish the Proceedings of the Ohio Academy of Science as a separate publication, but only in the OHIO JOURNAL OF SCIENCE, the mailing lists of the Academy and the Journal were combined in July, 1931. So for the first time there is lacking from this annual report the statement that the Proceedings of the previous year had been mailed to all the members and exchanges of the Academy. The five standing orders for the purchase of the Proceedings as a separate set were unavoidably lost.

The charter granted by the State of Ohio in 1892 to the Ohio State Academy of Science and the later amendment authorizing the elimination of the word "State," were found in the University Library during the summer of 1931. They have been given to the Secretary of the Academy for preservation.

The supply of the printed lists of available publications became exhausted recently. A new supply has been mimeographed at lest cost than if it had been printed and is just as satisfactory.

The sum of $89.40 for the sales of 1930–1931 was not given to the Treasurer of the Academy until January 6, 1932. The delay was due mostly to the widespread difficulty in withdrawing money from building and loan companies. In addition, the sum of $45.60 has been given to him on the sales account for 1931–1932, making a total of $135.00 transferred from the library fund to the general fund within the last few months.

The sales for the past year amounted to $87.45. The last annual report stated that a complete set of the Proceedings had been sold to a college library. The sale of another nearly complete set is reported this year. The price of a set makes a substantial addition to the total amount of sales. No more complete sets can be sold unless some copies of Special Paper No. 15, Prof. Schaffner's "Trees of Ohio and Surrounding Territory," can be found somewhere or returned by individual owners.

An examination of the sales shows that 129 items were sold in 44 sales, as against 166 items in 56 sales for the preceding year. There were 37 fewer publications sold, but the total amount is nearly as much, lacking only $1.95. This is due to the fact that the papers which were most in demand were the highest priced ones, having been Prof. Jones' "Birds of Ohio" and Dr. Osburn's "Fishes of Ohio," selling for $2.00 and $1.00, respectively. Eleven copies of each were sold. Next in demand were Prof. Hine's "Tabanidae of Ohio," Max Morse's "Batrachians and Reptiles of Ohio," and Dr. Stover's "Agaricaceae of Ohio," with 7 copies each. Eight of the eleven copies of the "Fishes of Ohio" were sold last summer at the Franz Theodore Stone Laboratory.

at Gibraltar Island to the students in Dr. Osburn's Ichthyology class. A number of copies had been taken up there for this particular purpose and results were not disappointing. The same result may occur again this year.

Only 5 of the 44 sales were made to people in Columbus, 20 to those in other cities in our own State, and 19 to persons residing in twelve different States. These States extend over the greater part of the whole country except the south and southeast, being Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, West Virginia, Indiana, Michigan, Minnesota, Washington, Arizona and Texas.

The following financial report is submitted:

RECEIPTS.

Cash balance on hand April 2, 1931	$ 83.49
Collected on 1930–1931 sales	30.90
Sales for 1931–1932	87.45
Bank dividends for 1931	5.61
Total Receipts	$207.45

EXPENDITURES.

A. E. Waller, Treasurer, for sales, 1930–1931	$ 89.40
A. E. Waller, Treasurer, on account, 1931–1932 sales	45.60
Government two mill tax	.30
Total expenditures	$135.30
Balance in bank April 28, 1932	$ 70.55
Cash on hand	1.00
Outstanding accounts	.60
Expenditures, 1930–1932	135.30
Total	$207.45

SUMMARY OF ASSETS

Unexpended balance on 1931–1932 sales	$ 41.85
Accumulated bank dividends, 1926–1931	30.30
Total assets	$ 72.15

Respectfully submitted,

ETHEL M. MILLER,
Chairman.

Report of the Auditing Committee.

DELAWARE, OHIO, April 30, 1932.

To the Ohio Academy of Science:

We have examined the Librarian's Financial Report, together with all bank statements and cash on hand, and find the report correct.

Respectfully submitted,

M. E. STICKNEY,
E. H. JOHNSON,
Auditing Committee.

Report of Committee on Publications.

DELAWARE, OHIO, April 30, 1932.

To the Ohio Academy of Science:

The report of the Publications Committee is purely formal. There were no Special Papers published during the year. The Proceedings of the Forty-first Annual Meeting, including the Presidential Address and Authors' Abstracts, were assembled and seen through the press by our efficient Secretary, and published in the July, 1931, number of the OHIO JOURNAL OF SCIENCE, except for the Authors' Abstracts of the Psychology Section which were printed in the November issue of the Journal.

Respectfully submitted,

F. O. GROVER,
Chairman.

Report of Special Committee on Relation of the Ohio Academy of Science to the Ohio Journal of Science.

In the report of this Committee presented at the Annual Meeting of 1931 (and presumably adopted by the Academy, although the Proceedings, p. 220, record the report as "received" and "ordered filed") are the following recommendations:

"The committee recommends to the Ohio Academy of Science:

First. That it is desirable that the Ohio Journal of Science be published and controlled jointly by the Ohio Academy of Science and the Ohio State University.

Second. That the Ohio Academy of Science enter into such a relationship on the following conditions:

1. That the Ohio State University set up an agent that will be legally responsible for the University's interest in the Ohio Journal of Science.
2. That the Ohio State University, or its agent in the matter, agrees to the appointment of a joint Administrative Board for the Ohio Journal of Science. This Board shall consist of four members, two to be appointed by the Ohio Academy of Science from its membership outside the Ohio State University, and two by the Ohio State University or its agent. (Further details of this item omitted. See p. 236.)
3. That it will be mutually agreed by the Ohio Academy of Science and the Ohio State University, that this plan may be terminated on a year's notice by either party.

It further recommends:

That the present special committee on the Academy's Relation to the Ohio Journal of Science, jointly with the Publications Committee of the Academy, be charged with the negotiations with the Ohio State University looking to the adoption of the plan by the University."

On May 20, 1931, the Trustees of the University adopted the following minute, including essentially the substance of the Academy's proposition, although with some minor differences:

"That the interest of the University in the Ohio Journal of Science be reaffirmed, and in order to establish a more definite plan of co-operation with the Ohio Academy of Science in the publication of the Ohio Journal of Science, the following proposals be approved:

1. That the President of the University be designated as the agent of the Board of Trustees in this connection.

2. That such agent be authorized to appoint two members chosen from the science departments of the University, to serve, one for a period of two years and the other for a period of three years, and their successors.
3. That the Ohio Academy of Science designate two persons, not members of the University Faculty, to serve, one for a period of two years and the other for a period of three years, and their successors.
4. That the normal terms of service of such members be three years.
5. That the four members mentioned constitute a joint administrative board.
6. That the duties of such joint administrative board shall be to manage the Ohio Journal of Science under such conditions and terms as such board may establish.
7. That the right to use the name Ohio Journal of Science, the ownership of back numbers of said Journal, and all periodicals received in exchange for said Journal shall be and remain in the University, in case such co-operative plan should be terminated.
8. That the proposed co-operative arrangement may be terminated upon one year's notice by the University or the Ohio Academy of Science.
9. That the University will continue its annual contribution for the publication of the Ohio Journal of Science.

In view of this unexpectedly prompt action by the University, a conference of interested parties was held in Columbus on June 30, 1931. This conference took the following action:

"Subject to immediate ratification by the Special Committee of the Academy on the Relation of the Academy to the Ohio Journal of Science (acting jointly with the Publications Committee) and the Executive Committee of the Academy and to final ratification by the Ohio Academy of Science, the following working plan for the Journal was adopted June 30, 1931, by Herbert Osborn (editor), E. N. Transeau (University member of the administrative board), A. W. Smith (president), C. G. Shatzer (executive committee), W. M. Barrows and F. L. Landacre (present editorial board), and E. L. Rice (chairman, committee on relation of Academy to Journal).

"NOTE.—A parenthetic (U) or (A) following a passage in quotation marks indicates that the quoted passage is taken from previous action of University or Academy, respectively.

"The Ohio Journal of Science shall be published jointly by the Ohio State University and Ohio Academy of Science under a Joint Administrative Board as was recommended by the Academy at its April meeting, and as was voted by the Trustees of Ohio State University in their meeting of May, 1931.

" 'The Joint Administrative Board shall consist of 'four members, two appointed by the Ohio Academy of Science from its membership outside the Ohio State University, on nomination by the Nominating Committee of the Academy, and two by the Ohio State University or its Agent' (A), 'chosen from the science departments of the University' (U).

" 'At the time of the establishment of this Board, one University member and one Academy member shall be appointed for two years, and one each for three years. Thereafter, appointments shall be for term of three years and may be renewed on expiration' (A).

" 'The function of the Joint Administrative Board shall be to determine the larger editorial policies and practices of the Ohio Journal of Science. The Board shall appoint 'the Editor, Business Manager and such Editorial Staff as seems desirable' (A).

" 'The Editor-in-Chief and Business Manager of the Ohio Journal of Science shall participate as non-voting members in the deliberations of the Administrative Board. In the event of a tie vote in the Board, the Editor-in-Chief may cast the deciding vote in all matters except that having to do with appointments to the positions of Editor-in-Chief and Business Manager' (A).

" 'The Administrative Board shall meet at least once a year. Four shall constitute a quorum for transaction of business. In the event of absence of one representative of either party to this agreement, proxy is given by this agreement to his colleague to vote for the absent member on all matters before the Committee' (A).

" 'The Board shall elect its Chairman and Secretary, shall keep records of its actions and transmit a report to the Academy at the Annual Meeting, and to the Agent for the Ohio State University. This report shall record important decisions and shall include the financial statement of the Ohio Journal of Science for the immediately preceding fiscal year of the Journal of Science' (A).

The Academy, annually, shall pay toward the support of the Ohio Journal of Science $1.50 for each of its members in good standing, in return for which the Ohio Journal of Science will be sent to each such member.

" 'The University will continue its annual contribution for the publication of the Ohio Journal of Science' (U).

"All income from sale of copies of the Ohio Journal of Science is to be returned as income to the Ohio Journal of Science; all publications, books and pamphlets, etc., received as exchanges from the Ohio Journal of Science during the period of joint publication are to remain in the Library of Ohio State University.

"The Ohio Journal of Science shall publish the Annual Report of the Ohio Academy of Science as one of its numbers as soon after the Annual Meeting of the Academy as practicable.

" 'This co-operative arrangement may be terminated upon one year's notice by the University or the Ohio Academy of Science' (U, A).

" 'The right to use the name Ohio Journal of Science, the ownership of back numbers of said Journal, and all periodicals received in exchange for said Journal shall be and remain in the University, in case such co-operative plan should be terminated' (U).

"It was further recommended:

1. That the Executive Committee of the Academy be requested to make present appropriation to the Ohio Journal of Science (in addition to the regular $1.50 per member) of an amount sufficient to cover the expense of issuing the Proceedings Number of the Journal or, at least, of an amount equal to the expense of independent publication of the Proceedings by the Academy.
2. That the further determination of the financial policy of the Academy to the Journal be left to the regular meeting of the Academy.
3. That the joint relation of the University and Academy to the Journal appear on the cover of each number and the title page of each volume of the Journal.
4. That an editorial statement of the new administrative policy of the Journal be published in the forthcoming Proceedings Number.
5. That the Editor be authorized to arrange for such additional copies of the Proceedings Number as may seem to him desirable, in consultation with the Secretary, Treasurer, and Librarian of the Academy.

6. That the Executive Committee appoint two temporary representatives of the Academy to serve on the Joint Administrative Board until representatives can be elected by the Academy.

7. That the Proceedings of the Academy be treated as a regular number (or part of a number) of the Journal without special pagination."

The proposed "working plan" was submitted, in above form, by the chairman to the members of the Joint Committee (Special Committee on Relations and Publication Committee) and was approved by E. L. Moseley, J. E. Hyde, F. C. Blake, F. O. Grover, and E. L. Rice. No reply was received from A. P. Mathews. M. L. Reymert had withdrawn from the Academy and his place on the committee had not been filled.

On July 28 the Chairman of the Joint Committee was notified that the Secretary of the Academy had received the approval of a majority of the members of the Executive Committee to the proposed working plan and to the appointment of C. G. Shatzer and E. L. Rice as *ad interim* representatives of the Academy on the Joint Administrative Board of the Journal. (This action was formally confirmed in a meeting of the Executive Committee on December 12, 1931.)

On the basis of these actions, two meetings of the Administrative Board have been held, October 31, 1931, and April 23, 1932, both Academy representatives being present at both meetings. The business of these meetings may be left for the report of the Board.

A meeting of the Joint Committee (Publication Committee and Special Committee on Relations) was held on April 29, 1932. F. C. Blake, F. O. Grover, and E. L. Rice were present; C. H. Otis met with the committee as proxy for E. L. Moseley, and E. L. Rice was authorized to act for J. E. Hyde.

The meeting agreed unanimously to present the following recommendations to the Academy:

1. That the Academy adopt the working plan already tentatively approved by the Joint Committee and the Executive Committee, and that the President and Secretary of the Academy be authorized to sign an agreement with the Agent of the University confirming this action.

2. That the Academy proceed to the election of two members of the Administrative Board of the Journal, one for two years and one for three years, as provided in the working plan.

3. That the question of the further publication of Special Papers by the Academy be left open for further consideration by the Joint Committee (Publication Committee and Special Committee on Relations) and report at the next meeting of the Academy.

4. That, in addition to the $1.50 per member now paid by the Academy to the Journal, the Academy also assume the expense of printing the number of the Journal including the 1932 Proceedings. (In the interpretation of this recommendation it is understood that $1.50 shall be paid to the Journal from each regular membership fee received by the Treasurer, including back dues as well as current. No definite limit was set to the cost of the Proceedings Number; but it is assumed that the Secretary will see that the cost shall not be excessive.)

5. That the Proceedings for 1932 include lists of officers and committees, reports, business transactions, presidential address, and such of the briefer papers or abstracts of longer papers as are placed in the hands of the Secretary at the time of the Annual Meeting. Abstracts to be limited to 300 words.

6. That the copy of the Proceedings be submitted to the Editor of the Journal within one month after the Academy meeting, the Proceedings normally appearing in the first issue of the Journal to go to press after the Academy meeting.

7. That the present Special Committee on Relations be continued for another year, and that the President of the Academy fill the vacancies in the Committee and appoint a member for the new Section of Geography.

8. That the Secretary of the Academy and the Chairman of the Special Committee on Relations be requested to draft such amendments of Constitution and By-Laws as may be necessary, and that this action be construed as notice of such amendments for action at the next meeting of the Academy.

Respectfully submitted,

EDWARD L. RICE,
Chairman.

Report of the Administrative Board of the Ohio Journal of Science.

The "working plan" under which the Administrative Board of the Ohio Journal of Science has been functioning is given in full in the report of the Special Committee on the Relation of the Academy to the Journal, p. 284. Since the approval of this plan by the Executive Committee of the Academy and the Joint Committee, consisting of Publication Committee and Special Committee on Relations, the appointment by the Executive Committee of C. G. Shatzer and E. L. Rice as *ad interim* representatives of the Academy, and the appointment by President Rightmire of F. C. Blake and E. N. Transeau to represent the University, two meetings of the Administrative Board have been held.

At the first meeting, October 31, 1931, F. C. Blake, E. L. Rice and C. G. Shatzer were present of the Board, together with Herbert Osborn, Editor, and B. S. Meyer, Business Manager of the Journal.

The Board organized by the election of E. L. Rice as Chairman and B. S. Meyer as Secretary.

It was voted that the calendar year be made the fiscal year of the Journal; and the following staff was elected for 1932:

Editor.....HERBERT OSBORN
Associate Editor.....L. H. SNYDER
Business Manager.....B. S. MEYER

Additional Members of Editorial Staff.

R. V. BANGHAM	E. R. HAYHURST	J. B. PARK
E. LUCY BRAUN	F. A. HITCHCOCK	J. P. PORTER
R. C. BURRELL	G. D. HUBBARD	L. H. TIFFANY
J. E. CARMAN	C. W. JARVIS	F. C. WAITE
A. F. FOERSTE	F. L. LANDACRE	

In the selection of the editorial staff the effort was made to secure representation for a wide variety of subjects and for various parts of the State.

At the second meeting, held April 23, 1932, all members of the Board, the Editor, the Associate Editor, and the Business Manager were present.

A number of detailed recommendations concerning the make-up of the Proceedings Number of the Journal were referred to the Committee

on the Relation of the Academy to the Journal, together with the request that the Academy assume financial responsibility for the cost of this number, in addition to the regular appropriation of $1.50 per member. All of these recommendations were favorably received by the Committee, as shown by its report, p. 284.

The following financial report was presented by the Business Manager and audited by a committee consisting of C. G. Shatzer and E. N. Transeau.

FISCAL YEAR 1931.

RECEIPTS.

Balance from 1930	$ 300.19
Annual University allowance	1,000.00
Dues from Ohio Academy of Science	757.50
Ohio Academy of Science, special payment on "Proceedings"	300.00
Subscriptions	78.00
Authors' payments for plates	71.52
Sale of volumes, back numbers, etc	21.68
Total Receipts	$2,528.89

EXPENDITURES.

Spahr and Glenn Co., Printing Volume 31	$1,812.00
Spahr and Glenn Co., envelopes	60.00
Bucher Engraving Co	205.16
James R. Geren, Postmaster	101.70
Labor and clerical assistance	13.90
Total Expenditures	$2,192.76
Balance on hand at end of fiscal year (Huntington National Bank, Columbus)	336.13
	$2,528.89

It is a pleasure to add, in conclusion, that all actions of the Administrative Board have been unanimous.

Respectfully submitted,

EDWARD L. RICE,
Chairman.

Report of Committee on Junior Scientific Endeavor.

By C. G. SHATZER, Wittenberg College, Chairman.

DELAWARE, OHIO, April 30, 1932.

To the Ohio Academy of Science:

Your committee appointed to promote Junior Scientific Endeavor among high school students has had personal and correspondence contact with a large number of superintendents, high school principals and science instructors during the past year. The results have been exploratory and experimental.

There are in the high schools science clubs under at least thirty names. The departmental clubs in many high schools are not correlating their work, nor are they engaged in co-operative activities. Many of the clubs are accomplishing fine results. The objectives in

many cases are similar to those suggested by the Ohio Academy in its plan for the promotion of Junior Scientific Endeavor. The departments are encouraging students to undertake group and individual projects in scientific fields as part of the activity program.

If the Ohio Academy wishes to stimulate further and better undertakings it must discover methods of encouraging what is being done and avoid conveying any impression to teachers that the objective is to promote further organization. The teachers now consider the high schools over-organized. The Ohio Academy can be of service to the high schools, but to secure results will demand an expenditure of money and time. The members of the Academy must give some of their time and enthusiasm in their own districts.

One satisfactory accomplishment of the committee this year was a district scientific conference of high school students in Springfield. The Urbana, South Charleston, Plattsburg, Yellow Springs, St. Paris and Springfield high schools were invited to participate in this conference. Several of these schools expressed themselves as interested and indicated that they would participate. Finally the departments of Biology, Chemistry and Physics of the Springfield High School presented a well-attended program.

The commendable features of this conference were:

1. The conference was conducted under student leadership with a minimum of teacher guidance.
2. Ninety-four individual and group projects were displayed and a select group demonstrated.
3. Although no announcement of the meeting was sent to the parents and to the general public, a considerable number of adults reviewed the projects and attended the demonstrations.
4. Fifty-five students were present.

The committee recommends that:

(1) The Academy's project be referred to the Executive Committee for review with power to act. The present committee is convinced that the project has merit and that the basic work done should not be lost.

It is further recommended that:

(2) The Executive Committee should be given authority to appropriate for the work a sum of money that it deems adequate to accomplish results.

Respectfully submitted,

THE COMMITTEE,

C. G. SHATZER,

Chairman.

Action by the Academy.

Upon the conclusion of the reading of the above report, the following motion was unanimously passed:

That the report be accepted with thanks to the committee, that the committee be discharged and that the recommendations contained in the report be referred to the Executive Committee with power.

Report of the Committee on State Parks and Conservation.

DELAWARE, OHIO, April 30, 1932.

To the Ohio Academy of Science:

At first thought one might consider that a report on Conservation activities might be a trifle out of place under present economic conditions, but a more deliberate survey will, we think, disclose a greater reason for careful attention to such matters. In time of stress such as we have been passing through there is all the greater need of deliberate thought on measures of conservation and plans for healthful opportunities in recreation. Therefore no apology is made for making this report cover not only items of progress but also suggestions for further effort. Even a dry committee report may serve as a slight diversion from economic cares.

It may be recalled that the subject of Conservation is not a new subject for the Academy. At the meeting held at Denison University in 1908 a program of several papers on different phases of the subject was submitted and a set of resolutions adopted which it may be appropriate to repeat here.

"The Ohio Academy of Science at its session in Granville, November 27 and 28, 1908, after a special program devoted to the discussion of the conservation of the natural resources of the state, adopted the following resolutions as expressing its position in regard to the importance and necessity of active measures for state conservation:

Resolved, That it is the desire of this Academy to place itself on record as favoring active efforts in support of the movement for rational protection of the resources of the country; that we cordially indorse the movement that has resulted in the formation of a National Conservation Commission, and urge the extension of its powers that it may direct the movement to a practical end.

We recognize the need in Ohio for action in the conservation of coal, and urge that measures providing for national control be enacted where state supervision is impracticable. We urge the importance of forest conservation and extension as a vital necessity for the future welfare of the state, and the formation of a forestry commission or establishment of a state forest service at the earliest possible time.

We recognize the necessity of immediate attention to the waterways and measures to conserve and utilize the possibilities for power, irrigation and navigation in the water areas, and of a scientific investigation of the biological resources connected with aquatic life, and urge the passage of a bill to establish a Biological Survey.

We would urge the formation by the Governor or General Assembly of a State Conservation Commission, at least one-half the members to be men of scientific training, to consider and report to the Government on important measures for conservation.

We recommend a Committee on Conservation in the Academy, and the arrangement for our next annual meeting of a special session devoted to a discussion of the questions pertaining to the conservation of the resources of the State."

It will be noted that some of the measures advocated at that time have been put in force, notably in the line of state forests and game refugees and also in the starting of the Ohio Biological Survey and the establishment of the State Division of Conservation. As it stands we do not have as yet a Conservation Commission one half of whose members are men of scientific training. However, we believe there have been sincere efforts to inaugurate desirable plans and we note with

satisfaction that the recently appointed Commissioner of Conservation is making a sincere attempt to do constructive work. The Commission has established in the line of game propagation a twenty-five acre raccoon ranch at Milan, Ohio, a 271 acre Cotton-tail Rabbit ranch at Milan, Ohio, and Propagation of Hungarian partridge and Ruffled grouse at the Urbana Game Farm.

For fish propagation, improved technique in hatching and rearing, including fertilization of ponds to increase production of entomostraca, spawning boxes for small-mouth black bass; keeping hatchery records and weighing fingerling fish before they are planted in order to accurately determine hatchery production.

The policy in stocking, planting only suitable species of fish in their natural habitats in closed streams where they will have a chance to spawn and their young to develop without being molested. Stocking according to habitat is also being applied to the distribution of ring-neck pheasants, Hungarian partridges and other species of game.

In the line of education and research they offer weekly radio talks; quail investigation; stream and lake surveys; publication of the following booklets: "Some Food and Game Fishes of Ohio" and "Ohio Game and Song Birds in Winter." And in fish and game protection, education of fish and game protectors in the broader aspects of Conservation.

The "Save Outdoor Ohio" Council has been promoting particularly the project of Bridge-Dams ably advocated by our Academy member, Mr. J. C. Goodman, and this plan has been taken up by the Division of Conservation, the Highway Department and the Water Conservation Board with a view to building some half dozen of these bridge-dams as trials in locations to be selected by the Water Conservation Board. The next step in this project is to have passed some very simple legislation that will make it possible to build these bridge-dams along county, municipal or state highways, wherever conditions seem to warrant it. The Council has also been giving much attention to the matter of promoting roadside beauty and it has under consideration legislation to regulate billboards and other interferances to roadside beauty.

The Wild Flower Preservation Society Ohio Chapter is undertaking an educational program, the aim being to put before the people of the state information as to what conservation really is and what it includes. The plan is to print copy for general distribution and it may be noted that a program of education including the importance of wild flower preservation is in progress by the Central Ohio Anglers' and Hunters' Club. Their entire program, however, includes conservation measures of still wider scope and a resolution adopted unanimously by the Club is worthy of inclusion here:

"WHEREAS, the season of wild field-flowers, ferns, shrubs and flowering trees is about to open, spreading the beauties and fragrance of Nature abroad for all people to enjoy; and

WHEREAS, vandalism is rapidly depleting all these beautiful things threatening their extinction, if it be continued, ere many years; therefore, be it, by the Central Ohio Anglers' and Hunters' Club,

Resolved, That this Club expresses its disapproval of and opposition to all forms of such vandalism; urges all persons to refrain from picking, removing or

damaging such wild field-flowers, ferns, shrubs and flowering trees, and requests the newspapers of Columbus and Ohio to publish this Preamble and Resolution, and to use it as a text for a concerted and persistent campaign for the general protection of such forms of wild life."

It is certainly encouraging that so many different organizations are becoming interested in phases of conservation and it is certainly desirable that we should endeavor to assist in directing these efforts in the most favorable channels. The establishment of a Water Conservation Board on which our Academy member, Mr. David C. Warner, is the Executive Secretary, inaugurates a comprehensive survey of the water resources of the state and this detailed program marked out by Mr. Warner should certainly result in some valuable advances toward measures for conserving and utilizing our aquatic resources.

We commend the Ohio State Forestry Department, under the leadership of Mr. Secrest, for the efficient manner in which the State Forests are being managed, making them available and usable for large numbers of citizens and visitors from other states. We regard these forests and parks as splendid object-lessons for our citizens in the principles of conservation.

While we are heartily in favor of making many of our State Parks and Forests accessible and available to the maximum number of citizens, we also regard it important that a number of choice situations be allowed to remain as inaccessible as possible and in as undisturbed condition as may be practicable for the use and study by students of ecology and other allied sciences. Such places should be regarded as sanctuaries for the preservation of such of our flora and fauna which are unable to survive under conditions which are likely to obtain when large numbers of people visit and wander about over the grounds of a state park. We recommend, among other sites of this sort, Conkle's Hollow, because of its relative inaccessibility at present and because of its comparative wealth of flora and fauna.

The discussion of geology by Dr. Ver Steeg of the geological features of the state parks will certainly be of much interest and it is hoped that he will complete a series covering at least the more important of the present state parks.

Recommendations.

We recommend the enactment of suitable legislation to protect our vanishing species of wild flowers and to protect the owners of lands adjacent to public highways from vandalism. Unless such legislation is soon enacted, lands adjacent to heavily traveled highways more recently opened to traffic will be stripped of their more attractive flowers and shrubs, just as the highways which have been improved for a greater length of time are already barren and despoiled of roadside flowers and shrubbery. Persons selling trees or shrubs taken from farms or forests might be required to have a license as required from nurserymen.

We favor legislation to increase the area of State Parks and Game Refugees as rapidly as they can be acquired and properly cared for.

We recommend that officers of the Conservation Committee be urged to set apart certain suitable areas as wild life refugees or sanctuaries within which all forms of native plants and animals may be left undisturbed, and that such places be not open to the public or provided with roads or public paths, but made available under proper restrictions for scientific observation by biological investigators duly authorized by proper authorities in charge.

We recommend that a careful study of the Roosevelt Game Reservation be made to determine the conditions favorable to permanent preservation of the native wild life of the state and that any introductions be limited to plants and animals native to this region to the end that this important refuge may serve as an outstanding feature in conservation particularly with reference to the perpetuation of the native game animals of Ohio.

We believe that all persons interested in conservation of our wild life should rally to the support of our birds of prey. Due to popular prejudice resulting in indiscriminate persecution of all species, our birds of prey are rapidly decreasing in numbers, some species being threatened with extermination. The great majority of our predacious species have long since been proven to be beneficial in their food-habits, while the few species known to be more or less destructive are so reduced in numbers that any damage attributable to them is negligible.

We recommend that all birds of prey be protected by law, subject to the right of any citizen to control them when in the act of destroying his property.

We further believe that the pole-trap is a wasteful and inhuman means of capturing birds of prey, since it not only does not discriminate between injurious and beneficial species of predacious birds, but also destroys large numbers of song-birds and game mammals. We therefore recommend that legislation be enacted making use of the pole-trap illegal.

The following areas are suggested for state park reserves:

1. Parts of Liberty Township, Jackson County. Here the Sharon conglomerate is a massive stratum from 50 to 200 feet in thickness and through weathering and erosion has been carved into deep narrow valleys or gorges. These offer fine scenery, have a selected flora and fauna, with southern affinities, and are easy of access. At present there is an attempt being made to have the State take over Rock Run. Such a move should be encouraged. Other parts worthy of preservation are Ophir Falls, White's Gulch, Vance Rock, and Big Rock.

2. Sunfish Valley in Monroe County. Stands out as one of the finest in the State. Here the relief is more than 600 feet, the valley narrow, and the walls steep and rugged. The Waynesburg sandstone outcropping about 300 feet from the valley floor causes many fine cliffs, sharp constricted valleys, and favorable places for selected plant and animal life. The best part of the valley is that between Cameron and Coats Station.

3. The Valley of Little Beaver Creek between Smith's Ferry on the Ohio River and Saint Clair or Fredericktown at the junction of North

Fork and Little Beaver Creek, eastern Columbiana County, is a narrow rugged gorge of recent origin. The stream is rock bound and has little or no flood plain. It is well worthy of preservation for its many natural features.

4. Since the abandoment of the interurban railroad, the Black Hand gorge on the Licking River east of Newark may be acquired for a small outlay. It is of interest for its scenery, life features, and geological history.

5. Brush Creek in Adams County offers much to the botanist and geologist as well as to those seeking scenery alone.

6. Luke Chute on the Muskingum River is one of the most beautiful spots in the State and should be preserved.

HERBERT OSBORN, *Chairman* E. LUCY BRAUN,
E. L. WICKLIFF, E. R. HAYHURST,
E. S. THOMAS, WILBUR STOUT,
ROSCOE FRANK, EDMUND SECREST,
Committee.

Action by the Academy.

The above report together with all accompanying Resolutions and Recommendations was, upon motion duly made and carried, accepted, approved and ordered filed.

NOTE: After the meeting the following letter was received from Mr. Secrest, who had been away at time the draft of report was sent to him:

"I have read the proposed report of the Committee on Conservation and State Parks and am glad to give it my approval.

As you know, funds for purchase of state forests and forest parks were not forthcoming at the last session of the Legislature, so we are doing nothing along this line excepting some clean-up purchases. The area of state forests and forest parks now total nearly 60,000 acres. From funds appropriated during the last biennium we have the past year added 12,786 acres of land to the state forest and forest park system. One more state forest unit was added—that of Zaleski Forest in Vinton County, of 3,393 acres. This contains some of the best first growth forest in the system.

I believe you and I have discussed the advisability of isolating choice sites that were to remain absolutely in their native condition, and to be inaccessible for promiscuous visiting. With this I am in hearty accord. For this purpose we have already set aside what is known as Little Rocky Branch in Hocking County, an area of about 300 acres. There are also portions of Shawnee Forest in Scioto and Adams Counties, and the Scioto Trail Forest in Ross County that could be set aside for this purpose. Springer Hollow in Hocking County could also be included. I think it might be well for the Conservation Committee of the Academy to establish a policy for these lands to be so set aside for their biologic interest. I think you will find that a number of areas now owned might be used for the purpose in mind. I am thinking of portions of the 3½ mile gorge connecting Old Man's Cave with Cedar Falls. Even though there is a trail through the gorge, there are lateral ravines that are never visited.

EDMUND SECREST."

Report of the Committee on Necrology.

To the Ohio Academy of Science:

The Committee on Necrology has submitted to the Secretary the following report:

Dr. A. B. Plowman.

This year saw the passing of Dr. A. B. Plowman, Professor of Biology at the University of Akron, a man long working in Ohio biological circles. He died January 3, 1932, after a lingering illness.

Amon Benton Plowman was born in Ohio, at the little town of Greenville, May 14, 1873, reared there, and at Ohio Wesleyan Academy and University, from which he graduated in 1899, with the degree of B. S. A broad interest in science and high scholarship, attested to by his part-time teaching in both physics and biology in these early days, led him to graduate work, which he did at Harvard. An intention to enter upon medical work was superseded by a growing interest in biology for its own sake. He majored in botany, taking the M. A. and then the Ph. D., completing the latter in 1905.

He taught at Harvard, and then at smaller colleges, spending some years as Professor of Biology at Carroll College, Wisconsin, after which he came to Akron, in 1915. Here in the old Buchtel College, then but recently made the nucleus of a municipal university, the department grew rapidly under his direction, both in students and in staff.

His technical training in botany, especially plant morphology, culminating in his Ph. D. dissertation and in other papers on Cyperaceae and Juncaceae, did not lead to later work in such lines. With his interest in all things biological, he developed more and more certain zoological interests, particularly in the various aspects of human biology. He was much concerned with biology in its relation to human welfare, and in public health measures. His favorite course, "Human Biology," presented material valuable personally, to great numbers of students. He taught a course in physiology, and at times genetics, and others, as well as formerly the general biology course. An outstanding feature of his teaching was a fluent but measured lecture presentation that always evoked attention.

Dr. Plowman was a member of the Ohio Academy since 1915, a fellow since 1920, and also Vice-President of the Botanical Section in 1920. He was a fellow of the A. A. A. S., a member of the Botanical Society of America, American Public Health Association, and others. He was also a member of Phi Beta Kappa, and Phi Sigma.

Dr. Plowman enjoyed a long, happy marriage. He retained throughout life an abiding interest in religion that meant much to him, and which was unobtrusively merged with his deep interest in science, in what was evidently a fine personal philosophy.

His characteristics of modesty, dignity, simplicity, kindliness in all his relations are richly remembered by his colleagues and friends.

Walter C. Kraatz.

Dr. R. A. Slagg.

In the death of Dr. Rodney A. Slagg, a member of the Ohio Academy since 1928, there occurred the death so lamentable, of a man still in his thirties, destined to do much and make much out of life.

Rodney Arthur Slagg was born at Fort Atkinson, Wisconsin, September 9, 1894. From his home town, he went to the Whitewater, Wisconsin, State Normal School for his training and first collegiate work. He taught biology in high schools, and then interrupted his career to serve in the World War. After his return, he resumed his teaching and studies. At the University of Wisconsin he took his B. S. in botany in 1923, and his M. S. in 1924. He taught at the Madison High School, and assisted in botany at the University while he started on his Ph. D. work.

In 1927 he came to the University of Akron as Assistant Professor of botany, and also gave a course in geology. His energy, enthusiasm, ability, and teaching qualities were soon recognized. On a leave of absence for the school year 1929–1930, he completed his Ph. D. work in botany at the University of Wisconsin in the summer of 1930. Another year of teaching was completed at Akron, and the following summer while again working at his favorite haunts in Madison, he died following an operation, August 6, 1931.

Dr. Slagg's dissertation was "The Gametophytes of Selaginella Kraussiana, I, The Microgametophyte," published in the *American Journal of Botany*, XIX, pp. 106–126, February, 1932.

He was a member of Phi Beta Kappa, Phi Sigma, Botanical Society of America, and the Ohio Academy. Dr. Slagg was not married.

Walter C. Kraatz.

Maximilian Braam.

(Prepared by L. Smith.)

Maximilian Braam, retired teacher of biology at Hughes High School, died suddenly at his home, 3449 Lyleburn Place, Cincinnati, October 11, 1931. He collapsed from an apoplectic stroke and died before a physician could be summoned.

Mr. Braam was born in Holland, September 8, 1850. After studying there and serving in the Dutch Army, he came to Cincinnati. Here he taught school for over 35 years. His first school was at North Bend and from there, in 1889, he went to the Third Intermediate School, at Cincinnati, in 1898 to the McKinley, where he was principal, and in October, 1904, to Hughes High School, where he taught biology. He retired in June, 1921, at seventy years of age.

While teaching school he became a student at the University of Cincinnati, where he continued his studies for over thirty years, sometimes as a day student and sometimes as an evening student. He received his Bachelor of Arts degree in 1906 and in 1914 the Master of Arts degree. He had completed practically all of the requirements for the Degree of Doctor of Philosophy and was preparing a dissertation on the Dialects of Zeeland as his doctor's thesis. In 1926 and 1929 he visited the Zeeland region of Holland and gathered material for his

paper. He had hoped to make another trip to the region before completing his thesis.

Mr. Braam was a teacher of biology for seventeen years and that field may be said to have had a major claim on his interests. But he did not exclude other lines of study. He was an enthusiastic student of Sanskrit and of the Old Norse and Icelandic languages. He spoke fluently not only in English and Dutch, the latter his native language, but also in German and French. He also spoke Italian and Spanish.

His scientific interests included astronomy, chemistry, botany and geology. He devoted some time to microscopic studies of plant and bacterial life. He was an ardent lover of poetry and some of his own contributions were published in the "School Index." Many of his former students recall with pleasure his custom of prefacing his lectures in biology with choice lines of poetry, some of which were the product of his own pen. Some of his former zoology students remember too his method of dramatizing elements in the life history of various species and retain indelible impressions as the result of his consummate technique.

Mr. Braam was secretary of the Ohio Botanic Garden Society and had been active in its efforts to develop a Botanic Garden at Cincinnati. He was a member of the Cincinnati Schoolmasters Club and of the Alliance Francaise.

WALTER H. BUCHER,
Member Necrology Committee.

Report of the Committee on the Election of Fellows.

DELAWARE, OHIO, April 29, 1932.

To the Ohio Academy of Science:

The Committee on the Election of Fellows met last evening in the Alumni Parlor, Edgar Hall, Ohio Wesleyan University, Delaware, Ohio, with ten members present and two absent (C. G. Shatzer and F. G. Tucker). The following members whose nominations were in proper form and accompanied by satisfactory documentary evidence of the nominee's scientific achievements, received the required three-fourths vote of the committee and were declared duly elected to Fellowship in the Academy, viz.:

S. PRENTISS BALDWIN
HOMER G. BISHOP
ALBERT FRANKLIN BURGESS
HARRY F. DIETZ
WINSTON F. DUNHAM
HAROLD A. EDGERTON
LINDEN F. EDWARDS
RAY LEE EDWARDS
ROBERT M. GEIST
LOUIS DUNTON HARTSON
ROBERT A. HEFNER
NEALE F. HOWARD
RALPH A. KNOUFF
CHESTER O. MATHEWS
FRANCIS NORTON MAXFIELD
ZENO PAYNE METCALF
CLAUDE R. NEISWANDER
JAMES RUEY PATRICK
SIDNEY L. PRESSEY
JOHN WORTHINGTON PRICE
J. P. SLEESMAN
GUY HAROLD SMITH
ISABEL SEYMOUR SMITH
LAURENCE H. SNYDER
AUGUST W. TRETTIEN
RICHARD STEPHEN UHRBROCK
WILLARD L. VALENTINE
EUGENE VAN CLEEF
GEORGE W. WHITE

Report of the Membership Committee.

DELAWARE, OHIO, April 30, 1932.

To the Ohio Academy of Science:

Your Committee on Membership submits the following applications in due form and recommends the election of the applicants to membership in the Academy:

BARTLETT, GERTRUDE, Dayton. *Botany.*
BEAM, J. ALBERT, Tiffin.
BEMISDERFER, F. R., Cleveland. *Chemistry.*
BONTRAGER, W. E., Oberlin. *Botany.*
BROWN, CLARENCE M., Columbus. *Pharmacy.*
CAIN, ADA DORRIS, New Concord. *Botany.*
CAIN, DR. STANLEY A., Bloomington, Ind. *Botany.*
CLARK, ROBT. L., Bartlett. *Entomology.*
CLIPPINGER, D. R., Athens. *Chemistry.*
CLIPPINGER, F. E., Dayton. *Botany.*
COLE, ARTHUR C., JR., Columbus. *Entomology.*
COLES, CLIFFORD H., Westfield, N. J. *Botany.*
DARLING, FRED S., Columbus. *Physical Sciences.*
DAVIDSON, RALPH H., Columbus. *Entomology.*
DREYER, WILLIAM A., Cincinnati. *Zoology.*
FORD, E. N., Wooster. *Physics.*
FRASURE, N. W., Basil. *Botany.*
FREEDMAN, M. A., Columbus. *Zoology.*
FREY, CARL A., Athens. *Medical Sciences.*
GARLAND, JOHN H., Columbus. *Geography.*
HANEY, JEAN WHITE, Columbus. *Botany.*
HAUB, JAMES G., Columbus. *Zoology.*
JANSON, EVA ELLEN, Columbus. *Biology.*
KEHOE, ROBERT A., Cincinnati. *Physiology.*
KERNHOLTZ, D. L., Columbus. *Botany.*
KING, DOROTHY D., Columbus. *Psychology.*
KIRK, W. J., Steubenville. *Physical Therapy.*
LANG, ALPHONSE, Cincinnati. *Biology.*
LIMING, FRANKLIN G., Columbus. *Botany.*
LUCAS, H. C., Columbus.
MADISON, WILLIAM JAMES, Wilberforce. *Physiology.*
MANUEL, WILLIAM A., Delaware. *Chemistry.*
MASON, PAUL, Columbus. *Botany.*
MELVIN, JOHN H., Chillicothe. *Geology.*
MOTOK, GEORGE THOMAS, Columbus. *Physical Sciences.*
OWEN, PROF. G. E., Yellow Springs. *Physical Sciences.*
PARRIS, FRANK G., Columbus. *Geology.*
PATCH, LAWRENCE H., Sandusky. *Entomology.*
PETERSON, VINCENT R., Cleveland. *Botany.*
PRICE, ERNESTINE, Columbus. *Botany.*
PYRTLE, RALPH N., Wilberforce. *Zoology.*
RIGG, MELVIN, Gambier. *Psychology.*
RISTOW, WALTER W., Oberlin. *Geography.*
SANDEFUR, B. T., Oxford. *Geology.*
SCHWARZ, HERBERT E., Columbus. *Medical Sciences.*
SCRANTON, ROBERT, Alliance. *Geology.*
SHARP, WINFORD L., Wooster. *Psychology.*
SHURRAGER, P. SHERIDAN, Athens. *Zoology.*
SMITH, LEON E., Granville. *Physics.*
STEVENS, MISS MARGARET E., Oberlin. *Geography.*
SUPER, CHARLES W., Athens. *Psychology.*
TURNER, J. J., Hiram. *Botany.*
WATSON, ALFRED N., Columbus. *Botany.*

WEISHAUPT, CLARA, Columbus. *Botany.*
WERDELMANN, WILHELMINE, Columbus. *Medical Sciences.*
WHITEFORD, CHARLOTTE, New Philadelphia. *Botany.*
WOLFE, JOHN N., Columbus. *Botany.*
YOUNG, IRVIN F., Columbus. *Botany.*

Respectfully submitted,
GEORGE D. HUBBARD, *Chairman,*
A. C. CONGER.

Report of the Committee on Resolutions.

DELAWARE, OHIO, April 30, 1932.

To the Ohio Academy of Science:

The Committee on Resolutions begs leave to offer the following resolutions:

The Ohio Academy of Science expresses its appreciation of the courtesies extended by the authorities of Delaware and the committees of Ohio Wesleyan University, and especially to the Chairman of the Local Executive Committee, Professor C. E. O'Neal, and to the management of Stuyvesant Hall for the splendid dinner served last evening.

We also heartily endorse the recommendations and resolutions presented by the Committee on State Parks and Conservation.

We further recommend that the Secretary express our appreciation to those concerned and inscribe these resolutions as a part of the minutes of this meeting.

E. LUCY BRAUN,
E. H. JOHNSON,
Committee.

Report of the Nominating Committee.

DELAWARE, OHIO, April 30, 1932.

To the Ohio Academy of Science:

Your Committee on Nominations has the honor to submit the following report:

President—R. A. BUDDINGTON.
Vice-Presidents:
A. *Zoology*—W. C. KRAATZ.
B. *Botany*—BERNARD S. MEYER.
C. *Geology*—CARL VER STEEG.
D. *Medical Sciences*—F. A. HITCHCOCK.
E. *Psychology*—L. D. HARTSON.
F. *Physical Sciences*—A. A. ATKINSON.
G. *Geography*—G. D. HUBBARD.
Secretary—WILLIAM H. ALEXANDER.
Treasurer—A. E. WALLER.
Elective Members, Executive Committee—ALPHEUS W. SMITH AND M. E. STICKNEY.
Trustee, Research Fund—HERBERT OSBORN.
Publications Committee—F. O. GROVER, FREDERICK C. BLAKE AND E. L. MOSELEY.
Library Committee—F. O. GROVER.
Committee on State Parks and Conservation—J. ERNEST CARMAN, E. L. WICKLIFF AND ROSCOE W. FRANKS.

Joint Administrative Board, Ohio Journal of Science:
For 3-year term—E. L. RICE.
For 2-year term—C. G. SHATZER.

Respectfully submitted,

WENCEL J. KOSTIR, *Chairman*,
EUGENE VAN CLEEF,
JAMES P. PORTER,
FRANK J. WRIGHT.

THE SCIENTIFIC SESSIONS.

GENERAL AND SECTIONAL.

The following is a complete list of the addresses and papers presented at the various general and sectional meetings of the Academy as reported to the Secretary:

The Dutch elm disease in Ohio.....O. N. LIMING
Description of an instrument for the accurate quantitative determination of cholorophyll.....R. E. OLTMAN
Motion Pictures: The treatment of osteomyelitis with blowfly larvae, D. F. MILLER, C. A. DOAN, E. H. WILSON
PRESIDENTIAL ADDRESS: Physics and Human Experience.....ALPHEUS W. SMITH
Supplemental Records and Notes for Ohio Leafhoppers.....HERBERT OSBORN
Temperature and the heart beat in Caddis Fly Larvae.....HENRY FEDERIGHI
Ecology of Ohio Band-winged Grasshoppers (Orthoptera; Acrididae; Oedipodinae).....E. S. THOMAS
A Preliminary Report on Mallophaga infesting Cowbirds.....ROBERT M. GEIST
Observations on a clone culture of Amoeba bigemma.....JOHN C. LOTZE
Protozoa of the alimentary tract of the wood-eating roach.....J. A. HERRICK
Breeding Hermit Thrushes feed migrating salamanders to nestlings during drought.....LOUIS B. KALTER
Observations on the nesting of the Black Throated Green Warbler, MARGARET M. NICE
A Preliminary Report of the Food Habits of Barn Owls at Ohio Wesleyan University.....ARTHUR STUPKA
Winter Feeding of Game Birds.....LAWRENCE E. HICKS
Tagging of Fish in Ohio.....RALPH V. BANGHAM
Insect Food Studies of some Lake Erie Fishes.....M. W. BOESEL
Controlling temperature in laboratory experiments: Types of apparatus used, CRAIG W. EAGLESON
Effect of certain Weather Conditions on Flight of Nocturnal Insects as Reflected by Light Trap Catches.....W. C. STEHR
A Study of Avicularia avicularia, the large spider often brought here in bunches of bananas.....R. L. BAIRD
The Effect of Salts in the Hydrogen Ion Concentration on the length of life in Asellus sp.....EMMETT ROWLES AND P. S. SHURRAGER
Discussion of Responses to Electrical Stimulation in the Leech..JOHN A. MILLER
The Origin of the Naiad Fauna of the Great Lakes Region.....H. R. EGGLESTON
Growth in Daphnia magna.....G. ANDERSON
Notes on Macrobrachium ohionis (large fresh-water shrimp), ROBERT N. MCCORMICK
Growth studies of certain fishes in Buckeye Lake.....WILBUR W. GRIMM
Food Habits of some Ohio Raptorial Birds.....ARTHUR STUPKA
The Fresh Water Medudae of Vermillion River.....R. L. BAIRD
A Cytological Study of the Glandular Epithelium of Lumbricus, THURLO B. THOMAS

The Effects of Various Foods upon the Metamorphosis of Blowflies..J. G. HAUB
A Study of Fertility in the Blowfly (Phormia regina).....FRANK COWAN
The Reactions of certain Cladocera to Colored Lights of Equal Intensity,
HYMEN LUMER
The study of living marine animals at inland laboratories.....W. J. KOSTIR
The Inheritance of Various Taste Deficiencies in Man.....LAURENCE H. SNYDER
The Phaenogenetics of Drosophila funebris.....WARREN P. SPENCER
The Effect of Strychnine Sulphate on the Melanophores of Eupomotis gibbosus,
GEORGE RUGGY
Encrangonyx mucronatus Forbes, a blind subterranean shrimp reported from Ohio.....STEPHEN R. WILLIAMS
Notes on a few interesting Florida Plants.....H. C. BEARDSLEE
Some Natural Color Photographs of Wild Flowers.....R. A. DOBBINS
The Living Cell and the Mechanism of Photosynthesis.....O. L. INMAN
Stomatal Investigations on Young, Mature, and Senescent Leaves,
GLENN W. BLADES
Starch Synthesis in the Variegated Leaves of Pelargonium,
A. G. CHAPMAN AND W. H. CAMP
Length of Water Conducting Vessels in the Elm Stem.....F. G. LIMING
The Water Deficit of an Extreme Xerophyte.....ERNEST H. RUNYON
Sectioning Woody Stems with Use of Steam.....ARTHUR T. EVANS
The Structure of the Flowers of Hemp.....W. H. CAMP
Orthogenic Evolution of the Degree of Divergence between Carpal and Foliar Leaves.....JOHN H. SCHAFFNER
The Forests of the Illinois Drift Plains of Southwestern Ohio....E. LUCY BRAUN
Xenia and Ectogeny versus Meta-xenia.....A. E. WALLER
The Vegetation of Logan County, Ohio.....OLIVER D. DILLER
Developing New Dusts for the Control of Apple Scab,
A. E. PIERSTORFF AND H. C. YOUNG
Grain Rusts in Ohio During 1931.....W. G. STOVER AND C. W. HORTON
The effect of ultra-violet light of various wavelengths on pigmentation and growth of bean seedlings.....R. E. OLTMAN
Stolons of the Trepostomata.....GEORGE B. TWITCHELL
Recent Discoveries in Early Paleozoic Strata in Northeastern China, Manchuria and Korea.....AUGUST F. FOERSTE
A possible pseudobornia from the Ohio Shale.....WILLARD BERRY
Base Saturation as an Indication of the Extent of Leaching of Surficial Materials.....G. W. CONREY
Plans for the Annual Spring Field Trip.....EDMUND M. SPIEKER
Salient Features of the Appalachian Valley in Virginia.....ARTHUR BEVAN
Pre-Cambrian Geology in Central Virginia.....A. S. FURCRON
A Bone-bed in the Delaware Limestone....LEWIS G. WESTGATE AND R. P. FISCHER
Some Ordovician Correlations in Southern Kentucky.....W. H. SHIDELER
Explanation of Certain Abnormal Sedimentation Behavior of Clay,
HAROLD G. CASSIDY
Solution Phenomena in the Basal Oneota Dolomite.....WM. A. P. GRAHAM
Glacial Limestone Deposits near Mt. Liberty, Ohio.....RICHARD C. LORD
Pre-Cambrian in Ohio.....GEORGE D. HUBBARD
Network Passages and the Origin of Limestone Caverns.....A. C. SWINNERTON
The Caves of Yarim Burgaz, Turkey.....GEORGE D. HUBBARD
Some Features of the Drainage History of the Upper Ohio.....G. F. LAMB
Drainage Changes of the Upper Mahoning River,
ROBERT SCRANTON AND G. F. LAMB
Gasoline Pollution by Underground Water.....KARL VER STEEG
Cross Warping in the Acadian Appalachians.....H. DAYTON SQUIRES
The Treatment of Tularemia with a Specific Antiserum.....LEE FOSHAY
The Effect of Various Stimuli on the Basal Metabolic Rate, the Blood Pressure, and the Galvanic Reflex in Man.....E. ROWLES AND J. P. PATRICK
Child Labor in the United States as Subjected to Poisons and Dusts,
EMERY R. HAYHURST
Data on Ventilation Conditions—A Field Neglected by the Physicians,
EMERY R. HAYHURST

The Ultra Violet Absorption Spectra of Vitamin B Concentrates as Correlated with their Potencies.....FRANCIS F. HEYROTH AND J. R. LOOFBOUROW
The Effects of Small Amounts of Ethyl Alcohol on the Respiratory Exchanges During Rest, Work and Recovery..ROBERT C. GRUBBS AND F. A. HITCHCOCK
Vaccine in the Prevention of the Common Cold.....W. E. BROWN
The Metabolism of a Woman 106 Years Old,
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The Acceleration of the Ulcer Producing Action of Bile Salts.....L. H. SCHMIDT
The Central Connections of the Eighth Cranial Nerve in the Guinea Pig,
RUSH ELLIOTT
Decomposition Products of Chlorophyll in a Herbivorous Animal and the Relationship of these Products to Haemin.....PAUL ROTHEMUND
Teaching Scientific Methods in Health Education.....MRS. NORMA SELBERT
A Chemical Study of the Blood in Quiet and Excited Rabbits.....H. L. KATZ
Some Observations on the Relation of Bodily Weight to the Mental Status in Schizophrenia (Dementia Praecox).....CARL SAWYER
Hematoporphryn, an Artificial Proteolytic Enzyme.....M. J. BOYD
The Ingestion and Excretion of Lead in Primitive Life.....ROBERT A. KEHOE
A Physiological Mechanism in Control of Blood Coagulability.....DON D. IRISH
Sodium Ricinoleate in the Detoxification of Bacterial Antigens,
STANLEY E. DORST
On the Chemistry of the Hinton Test for Syphilis:
(1) Nature of the Muscle "Antigen".....SHIRO TASHIRO
(2) A Synthetic "Antigen".....MISS C. M. VACK
The Energy Cost of Muscular Exercise.....HOWARD E. HAMLIN
(Professor Hamlin will also give a demonstration of a new simplified Sphygmograph recently invented by himself and Professor Hindman.)
Report of a Malignant Sacro-Coccygeal Chordoma,
VERNE A. DODD, HARRY L. REINHART AND RALPH A. KNOUFF
The Development of Funtionally Specific Ectodermal Placodes in Rana Pipiens.....RALPH A. KNOUFF
Data on the Problem of the Descent of the Testis.....L. C. GERLINGER
The Behavior and Autopsy Findings in a Case of Cerebellar Agenesis in a Dog.....GRANT O. GRAVES
The Neurological Findings in a Case of Cerebellar Agenesis in a Dog,
F. L. LANDACRE
An Apparatus for Studying the Reactions of Newborn Infants to External, Thermal Stimuli.....W. J. CAMERON
A Case of Microcephaly believed to be due to Roentgen Irradiation During Foetal Life. (Demonstration of the patient, slides, and discussion),
FRANCIS N. MAXFIELD
Physical Health and Psychological Adjustments in Children..A. SOPHIE ROGERS
A Method for Measuring Changes in Attitude Resulting from a Radio Talk,
F. H. LUMLEY
Emotional Status of Parents of Problem and Psychopathic Children,
EDNA R. LOTZ
Changing Relationships of Ability and Scholarships Measured During Four Years of University Study.....W. C. HALSTEAD
A Study of Senescence.....K. SWARD
An Experimental Study of Persistency,
JAMES P. PORTER AND LEONARD L. HENNINGER
Learning of Mechanical Puzzles by White Rats. (Motion picture demonstration).....H. HANSON
An Experimental Comparison of Psychophysical Methods....J. P. CURTZDAFNER
The Program of the Ohio Mental Hygiene Association.....C. S. SHERWOOD
The Relation between Length and Difficulty in Motor Learning; a Comparison with Verbal Learning.....THURMAN C. SCOTT AND L. L. HENNINGER
The Work of the Bureau of Examination and Classification, Columbus State Penitentiary.....G. R. MURSELL
Psycho-genesis.....ROGER BELLOWS
Why do College Students Differ in Moral Attitude and Religious Beliefs: A Statistical Study.....C. W. GLEASON

Final Revision of the Crystal Structures Present in Certain Chromium-nickel Alloys.....J. O. LORD AND F. C. BLAKE
An Exact Determination of the Ratio of the Edges of the Unit Lattices for Calcite and Rock Salt.....F. C. BLAKE AND E. W. FORD
Laue Photographs of Piezoelectrically Oscillating Quartz Crystals, CARL E. HOWE
The Use of the F. P.-54 Pliotron in the Measurement of X-ray Absorption Coefficients.....J. E. EDWARDS
Radiation Attending Low Critical Potentials in Mercury Vapor. (Preliminary Report).....N. SHAWHAN
Experiments on the Tetrode Oscillator.....W. C. SEARS
Stabilization of Oscillating Circuits used to Drive Quartz Crystals, D. W. BOWLAND
Heat of Vaporization and Charles' Law Apparatus for First Year College Physics.....C. W. JARVIS
Use of the Curved Mica X-ray Spectrograph in Undergraduate Instruction, J. F. HAINES
Dynamical Stability in Stars.....H. M. ROTH
Zeeman Effect Observations.....R. A. LORING
Discussion on "The Preparation of Students for Graduate Work in Physics." PROFESSOR ALPHEUS W. SMITH will open the discussion and will present some of the difficulties encountered by students in their graduate work.
An Experiment with the Symposium Method of Teaching. (An attempted integration of the physical sciences on the nature of matter), WILLIAM LLOYD EVANS AND JESSE E. DAY
Fluorescence of Chlorophyll-metal Complex Salts, H. V. KNORR AND V. M. ALBERS
Frequency Determination with Demonstration.....THEODORE F. KUECHLE
Fluorescence of Chlorophyll a and b and Oxidation, V. M. ALBERS AND H. V. KNORR
Raman Spectra of a Series of Organic Chlorides.....R. R. HAUN
The Gamut of Radiation.....W. R. PYLE
Demonstration of some New Mechanical Wave Models.....ISAY BALLINKIN
The Use of the Milling Machine as a Precision Optical Bench..JOSEPH JOHNSON
Repulsive Forces in the Heads of Comets.....N. T. BOBROVNIKOFF
Soil Development in Ohio.....G. W. CONREY
Influence of Physiography in the Campaign around Chancellorsville, KARL VER STEEG
Topography and its Utilization in the Fiord Portion of Central Norway, GEORGE D. HUBBARD
Notes on the Vegetation of Ireland with Special Reference to the Limiting Factors of Geographical Distribution.....A. E. WALLER
The Prairie Peninsula.....E. N. TRANSEAU
A Geographic Interpretation of Wheat Production on the Columbia Plateau, JOHN H. GARLAND
Some Elements of the Cultural Landscape on the Lake Plain of Northern Ohio, REUEL B. FROST
Nationalistic Elements in Farming in Northwestern Ohio..CARL DUDLEY VARVEL
The Influence of the Charcoal Iron Industry on Southern Ohio...WILBUR STOUT
Sequent Occupancy of a Village on the Ohio Till Plain.....ALFRED J. WRIGHT
A Phase of the Geography of Chattanooga.....N. C. BURHANS
Washington's Lands in Ohio.....GUY HAROLD SMITH
Experiences in Giving Geography Instruction by Radio.....W. R. MCCONNELL
Factors Explaining Ohio's Freak Winter in 1932.....PARIS B. STOCKDALE

PRESIDENTIAL ADDRESS.

PHYSICS AND HUMAN EXPERIENCE.*

ALPHEUS W. SMITH.

We are living in a period in which our evident failure to understand and iterpret our human experiences, more and more fully justifies a sympathy with the mood of Mathew Arnold when he wrote,

> "And we are here as on a darkling plain,
> Swept with confused alarms of struggle and flight,
> Where ignorant armies clash by night."

The reason for this confusion and uncertainty in our social and economic life has been attributed in rapid succession to overproduction, overcapitalization, excessive developments in technology, inefficient means of distribution, high taxes and too much emphasis on scientific education, without pausing to recognize that the universe is a complex group of physical, biological and social phenomena which demand clarification and interpretation before human experiences can be organized and made the basis for future programs and policies. Indeed it does seem that science has produced a complex civilization which has far outrun our ability to control and direct social and economic phenomena, for a hasty survey of the achievements of science in the last century reminds us very vividly of the disparity between the brilliant advances in science and the ineffective methods for the control of public affairs. Hence we must recognize that while science has developed fabulous and undreamed of powers, we have yet to discover how they may be made most effective in the shaping of our social, economic and spiritual experiences. With this thought in mind John Dewey says "The great scientific revolution is still to come and it will ensue when men collectively and cooperatively organize their knowledge to achieve and make secure social

*There is no element of originality in this address. Even its phraseology is more or less common to all physicists. It only aims to organize simply and briefly some of the thoughts and points of view which are becoming a common heritage. In its preparation the following books have been of the greatest value: Eddington's "Nature of the Physical Universe;" Jeans' "The Mysterious Universe;" Darwin's "Modern Conceptions of Matter" and Dingle's "Science and Human Experience."

values." But the physical and biological sciences are human creations, universal in their origins and their outlooks and if we are to have a greater science it must also be of human origin and must arise out of a larger unity of thought and purpose which will draw together an incomprehensible wealth of physical, biological and social phenomena, and through its spirit and method will carry with it a rule of life and a vision without which the people perish.

Now it is impossible here to indicate the methods and scope of this science which shapes the material environment of our lives and forms the predominant constituent of our intellectual atmosphere. Nor is it my purpose to suggest that science offers a sure method of escape from the present or any future threat of doom. I only mean to suggest that the rapid advances in physical thought, especially in subatomic physics, suggest the type of thinking necessary for an interpretation and a correlation of those more complex human experiences found in the field of biology and social relations and for the building of an intellectual habitation which takes account of the fact that we are human beings living in a physical world. I am assuming that the material results of physics are immediately obvious to all but that its philosophical framework, its methods, its aims and its rigorous disciplines very largely escape those who have not had considerable experience in it or allied subjects. It will be sufficient therefore for my present purpose to make somewhat clear the method of modern physics—a method based on sound scientific thought supported by accurate and unambiguous experiments and to suggest that this type of thinking has great significance in other fields of knowledge and that it is perhaps the only type of thought which is sufficiently well founded to give us the confidence we need for vigorous and unhesitating action in social, economic and political affairs.

II.

It is the task of the physicist to reflect on the nature of the happenings in the physical world and to work out some scheme which will bring order and regularity into the conflicting appearances in which the tangle of physical phenomena manifest themselves. He deals entirely with the facts of observation and tries to reduce them to a system so that certain sequences of phenomena are necessary consequences of the system. He

of course must assume that there are universal regularities among physical phenomena and that there is an understandable organization in the physical universe and that these regularities and this organization may be described in terms of invariants which are in the long run independent of the observer and his mental attitudes. Each advance consists in bringing into this organized system a group of observed phenomena. whose interpretation is in agreement with the general methods and principles of the system. The reasoning must begin and end with observation and no entities other than observable entities must be used in the analysis. The problem then becomes a game of putting observations into a framework of mathematical descriptions.

There are two methods of procedure and one or the other must be used according to the nature of the observations to be correlated. These methods are (1) the method of abstraction and (2) the method of hypothesis. Newton was the supreme exponent of the method of abstraction. He formulated principles which were inseparably wedded to the phenomena. This can not be done by formulating hypotheses for an hypothesis is only one of many possible guesses and it is impossible to know which of these guesses is the true one. Newton therefore relied on the method of abstraction. He says, "I frame no hypotheses. For whatever is not deduced from the phenomena is called an hypothesis and hypotheses whether physical or metaphysical have no place in experimental philosophy." But this attitude could not continue with the growth of physics and the increase in the complexity of the data. The period of Newton was in part superseded and in part supplemented by the period of hypotheses.

Every observer of physical phenomena before Newton must have inquired about the conditions which determine the path of a flying arrow, a falling stone or a rotating wheel. Yet before Newton all of these motions were without regularity or order. It took the genius of Newton to see the simple rule which unites and interprets them. To get this final rule Newton observed that there is a certain set of properties and characteristics in all bodies, independent of time and space—a set of characteristics which can be relied upon to help give a description of motions. This entity he called mass. From experiences arrived at from muscular exertions, he abstracted and generalized the concept of force. Experience having also

given the concepts of time and space, it was possible to deduce the idea of change of position in a given time and the rate of change of position or acceleration. With these three abstracted concepts he formulated the desired rule which describes the behavior of moving bodies. Then this whole complex system of physical phenomena became organized and systematic. One simple rule $F=Ma$ simplifies and unifies the whole situation. The process has been to abstract from phenomena certain unchanging entities in terms of which phenomena can be described and put these entities together in a simple mathematical formulation. In other words the rule had been abstracted from the phenomena themselves. No hypotheses, verifiable or unverifiable are present in the process.

A continuation and an extention of this method gives the law of gravitation and the ordered motion of planets and other astronomical bodies. Here there is nothing about causes or effects. It is a description of regularities in terms of entities abstracted from the phenomena themselves.

The major illustration of the method of abstraction is found in the principle of relativity. Newton's laws of motion were understandable only if bodies with accelerated motion could be distinguished from bodies at rest or in uniform motion. To insure this differentiation Newton postualed absolute time and absolute space as independent entities. What happened here would happen there. There could be no differences in time. Now it was not necessary that absolute velocities be definitely observed. It was only necessary that such velocities could be definitely conceived. From the definition of absolute velocities easily followed definitions of relative velocities which were consistent with all experience up to Newton's time but the theory of relativity becomes a necessity when high speeds such as Newton had not occasion to consider became observed facts. Here the requirement that knowledge begin and end with experiment demands that we abandon the concept of absolute time and space. The result is that Newtonian velocity, acceleration and force have no meaning for these high velocities. Newton's scheme is incapable of correlating these experiences. A new scheme must be adopted. In this new scheme there is a union of time and space, remembering that the way in which they are to be united is determined by experiment. The result is as if we formed an abstract medium which has four dimensions, length, breadth, thickness and time instead of two

abstract media, time with one dimension and space with three dimensions. When described in terms of this new medium *space-time*, the laws of motion and gravitation are united. Instead of three abstractions space, time and force we have one *space-time*. Now here *space-time* is an abstraction from observation to describe experience. This is the greatest achievement of the method of abstraction. It dispenses with the force of gravitation as a means of description and gets the same results in terms of the properties of *space-time*. But after all Einstein has extended Newton and elaborated the Newtonian principles over a region of phenomena which Newton never knew. He has started with observation, abstracted certain concepts from these observations and subjected the conclusions to the test of further observation. Einstein's method is just like that of Newton but it is more comprehensive. He uses fewer and simpler abstractions but they are less familiar. His concept of a unified space-time absorbs all the Newtonian concepts of space, time, mass, gravitation, momentum, energy and electric and magnetic forces. It is a method of synthesis in which the phenomena of nature lose their individuality.

The interplay of abstraction, conceptual reasoning and hypothesis can be illustrated by a contrast of the attempts to describe physical phenomena in terms of particles and in terms of waves. At the very outset our sense perceptions gave us the concepts of particles, grains of sand or drops of water. But as smaller and smaller scale phenomena demanded interpretation, for example the diffusion of gases or the law of multiple proportions, it was necessary to reduce the size of this unit to smaller and smaller dimensions, ending for some time with the hypothetical atoms of Dalton which were not only unobserved but also unobservable. The properties to be assigned to these atoms were those necessary to make them capable of correlating the physical phenomena under consideration. For this purpose it was necessary to suppose that they were very small, hard, perfectly elastic spheres of infinitesimal mass, moving in absolute space and time and obeying those forces which had been found useful instruments of description and not necessarily entities which have physical reality in excess of that attributed to them for the explicit purpose of the description of phenomena.

When the discovery of the electron and the radioactivity

of certain elements brought forth facts which are not consistent with the older concept of an atom, it was necessary to introduce into the atom hypothetical concepts which with proper mathematical treatment are capable of describing these new phenomena. Just what new concepts were to be attributed to the atom were determined by the phenomena revealed by experiment. Any reasonable concept which proved helpful in the description of the phenomena might be added. However far the application of this method may lead us from the original ideas about an atom is not inconsistent with the best usages of physics. It only means that forty years ago the concept of an indivisible, unbreakable atom was sufficient to describe the then existing phenomena but this concept was to be shaped in the hands of the physicist as a sculptor fashions marble or bronze to express his ideas. The essential point of our present purpose is that, however, far the subdivision of the particle might be carried and however many and diverse concepts might be attributed to the particle, we have in the end a particle language in terms of which to describe physical phenomena, a language arrived at from sense perception but a language which is subject to experimental vertification. Now this language is extraordinarily but not universally successful in the description of the behavior of both matter and energy.

Fortunately sense perceptions give the physicist another concept—the concept of wave motion, which has proved equally important as a language in terms of which to describe physical phenomena. Suppose you drop a pebble into the surface of a pool of water. You find a system of waves going out from the center of this disturbance. If you observe the characteristics of this disturbance you can find a certain set of properties which can be abstracted from them, for example the wave length, the displacement, the frequency and the velocity. These universal characteristics we call the characteristics of a wave motion and find them useful symbols in terms of which to describe physical phenomena. We have now on our hands a second type of language in terms of which to correlate our observations and our ideas. We will be allowed to use whichever of these languages proves to be the most helpful for our purposes. The two types of language may after all be related to each other. Each may only be a half language to be later cemented into a completer language but for our present purposes we must use what is available.

Now let us try to describe some of the small scale phenomena in terms of particles. If we wish to describe the law of multiple proportions we need only think of small indivisible atoms. If we wish to describe the pressure exerted by a gas on the sides of the containing vessel, it is sufficient to make the particle a small perfectly elastic sphere and apply to it the ordinary laws of motion. If we wish to describe the discharge of electricity through a gas we must also assume that the particle is charged with negative electricity and that its mass is even smaller than that of the atom. Radioactivity will have an interpretation if we postulate two types of particles, one charged with positive electricity and the other with negative electricity. To account for other phenomena like band spectra, the atoms in the molecule must be supposed to vibrate with respect to each other and the molecule as a whole to rotate around one or more of its axes. We have thus added to the particle the possibility of vibration and rotation, concepts abstracted from gross phenomena. When we come to account for the spectra emitted by different atoms and through this data build up a picture of atomic structures, we assign to the electrons whatever characteristics are necessary for this purpose and develop a new system of mechanical laws. We supposed that the electron spins around its axis either in a clockwise or in a counter-clockwise direction and has a magnetic field associated with it. By attributing to the electron these additional concepts which were already familiar from sense perceptions, a larger group of data can be correlated and wider range of physical phenomena can be interpreted. But this concept of spin and the concept of a magnetic field must not be thought of as having any ultimate reality in connection with the electron. They must be thought of as fictions which are capable of describing observable realities. On this basis any working hypothesis is a tool to be supplanted at any moment by a better tool. Notwithstanding its great successes the particle theory was not all powerful and we must look at its limitations and failures. The first of these appear in the hands of Newton the greatest proponent of the particle theory of interpretation of physical phenomena.

When light passes from one medium to another in which the velocity is different, its direction of propagation is changed. Newton tried to describe this result in terms of the language of the particle theory. The description was unnatural and

forced. When Young observed the interference of light there emerged a set of physical phenomena with which the particle theory could not deal, that is, there was no method of description in terms of particles to account naturally for the results. It occurred to Fresnel to undertake the description of these phenomena in terms of the language of waves. The result was conspicuously successful and it led to a great number of important extensions of our knowledge in the field of light. Maxwell then extended and generalized the concept of wave motion until it included electromagnetic waves as well as waves in some material substances. From this generalization and abstraction there emerges the electromagnetic theory of light. It is important to note the process involved in the extension and generalization of this theory. On last analysis it says that the language of waves is an adequate language in terms of which to describe these phenomena. It does not say that light is a wave motion. It only shows that the concept of wave motion can be very successfully applied to this field of physical phenomena as an effective and adequate means of description. On the other hand the language of particles has failed in its attempts to describe and correlate these same phenomena.

But careful experiments on light have revealed new facts which can not be described in terms of the language of wave motion. The simplest of these is the group of phenomena associated with the discharge of electricity from the surface of a metal when it is illuminated with light of a definite wave length. There is also the phenomena of black body radiation and the wealth of phenomena in the field of X-rays, atomic structure and spectroscopy. Indeed the experiments in the field of subatomic physics have added such a wealth of data in this region that an entirely new theory has been developed to take account of it. For our purposes it is chiefly necessary to emphasize the fact that at first this theory used the language of particles clearly in contrast to the language of the waves. In other words when the language of waves had failed to describe the phenomena of subatomic physics there was a return to the particle language of description and this form of description has been extremely successful in correlating the observed phenomena and predicting new phenomena.

When it appeared that the language of the particle theory was about to prove adequate for a description of small scale

phenomena it was discovered that it was necessary to use the language of waves to describe some of the characteristics of particles. Of course this important result completely changed our attitude toward the particle theory and very forceably reminded us that after all we are dealing with concepts abstracted from gross phenomena and using these concepts for the description and correlation of phenomena. The experiment of G. P. Thompson on the scattering of electrons illustrates this important development. Professor Thompson sent a beam of electrons through a thin sheet of gold foil and observed the pattern produced on a photographic plate. He found a series of diffraction rings which were almost identical with the rings which are to be found when a beam of light passes through a small opening. Now the patterns produced by the beam of x-rays or the pattern produced by the light passing through a pin hole have been very successfully described in terms of waves and this method of description proves to be equally successful in the interpretation of the results of passing the beam of homogeneous electrons through the metal foil. That is in the language of particles there is no way to correlate these observed results but when the language of the wave theory is used the results are easily correlated and it is possible to calculate the wave length of the electron in terms of its velocity and the diameter of the rings. These calculations check beautifully with the predictions of the theory. There seems no more reason for regarding the electron as entirely a particle than there is for describing radiation entirely in terms of waves. The result is that both the concept of waves and the concept of particles are needed to describe the electrons and both the concept of wave and the concept of particles are needed to describe light and other forms of radiation. The results of these and similar experiments have lead to wave mechanics in which subatomic phenomena are described in a remarkable way in terms of wave equations.

The electrons and protons are then no longer thought of as particles. They are endowed with properties which resemble waves. When mental pictures are necessary, we try to unite in our minds the images of particles and waves. To unite satisfactorily such divergent images is after all impossible and this fact teaches that the coneptions of space and time as abstracted from phenomena can not be applied directly to these subatomic phenomena.

The electrons and protons are now to be represented by mathematical symbols but we are not to give them pictorial properties. By means of these mathematical symbols their behavior can be worked out and an increasing number of observations can be correlated. Each new set of observations may require a modification or an extension of the concepts of the atom but these modifications and extensions must be consistent with the former concepts attributed to the atom. Thus the new atom is a set of consistent concepts subject to the primary test that they effectively correlate phenomena. The language of waves and the language of particles thus supplement each other. Each is a half word. Both are necessary for a complete description. The discoveries of recent physics lead then to the conclusions that electrons, protons and photons, can be regarded only as concepts, possessing no properties and subject to no laws other than those which are necessary and sufficient to correlate observations. The question whether they are real or unreal has no meaning. Since they are unobservable they are not real in the sense observed existences are real. In dealing with such hypotheses we have perfect freedom to shape them as we please, provided they achieve the end for which they were created. We are not bound to give them the characteristics of phenomena. They are employed for rational correlation and not admissible to experience. They must have rational properties but not necessarily sensible ones.

From these concepts we are at liberty to make any hypothetical inferences we may choose to make so long as these inferences can be verified by observation. If the inferences drawn from the hypotheses pass this test they have all the justification possible for them. But now it is conceivable that they may do this and yet not be the only set of inferences which would give the same results. In such an event we have no criterion for distinguishing between alternatives. Hence we are compelled to regard such hypotheses as concepts with no necessary likness to phenomena and no obligation to obey any laws except those by which they issue in phenomena.

These unverifiable hypotheses constitute a new instrument of scientific correlation. They are essentially different from that more familiar type of hypothesis which has essentially the nature of a potential experience. You can not ask whether such an hypothesis is true or false. All you can ask is, "Does it correlate phenomena in an effective manner?" It is merely

a mental edifice into which any ideas can be introduced so long as they cement together actual experiences. The recognition and use of this type of hypothesis gives the physicist an enormous increase of power. He is no longer restricted in his thinking to those elements which can be imagined. He does not need to confine himself to elements which can be clothed in the characteristics of phenomena. He can use any elements he chooses and let them interact with each other in any conceivable way, provided they give rational correlation of phenomena. But when these instruments of correlation have been used and they have been found successful, it must not be inferred that they are true or real in any sense other than that they are successful instruments of description. They only show that nature is rational or that out experiences are consistent with reason.

We must not fail to recognize that it was a significant point of departure when physics ceased to confine itself to things that can be observed directly and began to employ concepts that do not appear to the senses—that is, invented at the base of the world so called entities which are not capable of direct observation but entities which are necessary to account for the facts of observation. It would seem at first sight that physics which began with emperical facts was headed toward a reign of pure reason but this conclusion is too hasty. It does not give proper consideration to the experimental checks on the reasoning.

Never before has the intellectual horizon been so extended as it has been since the physical sciences began to apply these methods. In the direction of large scale phenomena we have arrived at an almost limitless space populated with spiral nebulae, more or less uniformly distributed through a sphere which is about one million light years in radius. In the direction of small scale phenomena, we have determined the essential constituents of the atom and their arrangement with respect to each other and are now addressing ourselves to the still more difficult problem of the nucleus of the atom. An unlimited number of physical phenomena lie between these extremes, ready to be understood by the extension of these methods. The possibilities seem to be limited only by the imagination, experimental skill and intellectual ingenuity of man. But we must ever keep in mind that the physical world is not merely the sum of all its parts. Its nature lies in its constitution

and organization rather than in its parts. The part in the whole is no longer the same as the part when it is removed from its neighbors. There may be separate electrons but when they cease to be separate they cease to have the same properties. The electron in the core of the atom is unlike the electron when it is removed from the atom. In the end this means as Russell states it, "The world ultimately consists not of material stuff but of patterns, or organization, the evolution of which involves no absolute creation of an alien world of material out of nothing."

III

The history of the biological sciences shows that they are developing along somewhat parallel lines. At first there was an accumulation of observational and experimental data without any real organization but when the cell was isolated and introduced as a unit in terms of which biological phenomena could be described, the science of biology made a real beginning. Conditions in the biological sciences before this time were not unlike those that obtained in the physical sciences before the time of Newton, where no one recognized regularities or uniformities in physical phenomena. But the cell was too large a unit for the description of all biological phenomena just as the atom was too large a unit for the description of all physical phenomena. When the concepts of the chromosone and the gene had been abstracted from biological phenomena, new units were available in terms of which it was possible to set up rules for the description of the essential facts of heredity. It is non-essential for my present purpose that two of these units are microscopic and that the other is beyond the range of the microscope. What is essential is that out of biological phenomena, certain biological concepts or entities were abstracted and that these entities are used as invariants in terms of which to express accurate relations between biological data. Here again as in physics it must be recognized that the unit is not necessarily unique. The unit in the presence of other units has new properties and the interactions between such units must be carefully considered. It is the organization as well as the unit that is significant and it must also be recognized that these concepts—cells, chromosomes and genes—are correct for our purpose just so long as they offer us means of expressing the rules which connect up biological data. When these

concepts cease to be effective for the correlation of biological phenomena they must be extended, revised or abandoned. Just as in the case of the atom and the electron, they are plastic material in the hands of the biological sculptor.

Perhaps that state of awareness which we call consciousness was the first concept to be abstracted from the group of phenomena which is now included in the science of psychology. This of course was a gross and poorly defined concept but it served to account for a great group of phenomena common to all sentient beings. Its introduction into the field of psychology is not unlike the introduction of the concept of mass into the field of physics only it was possible to make more precise definitions of mass than it has been ever possible to make of consciousness. Now mass proved an effective concept in terms of which to describe large scale phenomena like the motion of the planets but was nearly useless in the description of small scale phenomena. In an analogous way consciousness proved to be too inclusive a term for the description of much of the more detailed psychological phenomena and has in recent years been more or less dispensed with by one group of psychologists. All this group of psychologists mean by their attitude is that the concept of awareness has ceased to be a helpful concept in the description of the phenomena in which they are interested. It is not a question of whether consciousness is real or unreal. It is only a question of whether it is useful or otherwise. The situation is much like the attitude toward the ether. It was used in physics as long as it was a helpful instrument of description and it was abandoned when more effective means of description became available.

There, however, is little hope that the psychologist may follow with safety a practice which appears from time to time—the practice of trying to describe psychological phenomena in terms of protons, electrons and photons. There is little reason for supposing that we are going to be able for a long time yet to use physical concepts for the effective description of either biological or psychological phenomena. That may come some time but for the present we must expect to get our descriptions of biological phenomena in terms of biological concepts and our description of psychological phenomena in terms of psychological concepts.

So far as I know only one good illustration of this method of analysis has appeared in that group of phenomena we call

art. It is the attempt of Professor George D. Birchoff to apply a mathematical method to the analysis of certain forms of art. We are not interested in his results. He may or he may not be successful but his method is scientifically sound and for that reason interesting and suggestive. It amounts briefly to following the method of Newton in the formulation of the second law of motion, and abstracting from the phenomena of art three concepts which can be used as invariants just as Newton abstracted from physical phenomena the concepts of mass. Professor Birchoff unites these concepts through a simple mathematical equation which comes out to be the analogue of Newton's second law. He then follows the method of the experimental physicist, tests his mathematical relation by suitably selected experiments and rests his case on the results of these experiments. Nothing could be more straightforward and if the results prove negative in a particular case at least we are assured that the method is valid.

Now consider an illustration from the field of the social sciences. To understand the present financial and economic situation it would be necessary to abstract from a large group of such phenomena, one or more invariants in terms of which to make adequate descriptions. Perhaps we thought that we had such a unit or invariant in the American dollar or the pound Sterling but when we examine this unit we find that it is not even approximately an invariant but fluctuates over a large range of values. Yet in terms of this variable dollar or pound Sterling, used as an invariant, we have been discussing profits and losses, reasonable scales of wages and incomes, the cost of government and satisfactory standards of living. The reasoning in such a case is likely to be about as trustworthy as if a physicist were to undertake to calculate the orbit of Neptune on the assumption that the mass of this planet is constant and then find by later observation that the mass varies over a wide range of values. Professor Irving Fisher recognizes this point when he suggests that we try to define a dollar in terms of its purchasing power, as measured by certain accepted and suitable chosen standards. By a continual readjustment and revision of the dollar in terms of these price indices we might get a fixed standard of value for the dollar. We could then ask whether wages are going up or down, whether profits are too high or too low and whether there is the proper equilibrium between capital and labor. Until such trustworthy units or

invariants are available and until they are used somewhat as the corresponding units in the physical and biological sciences are now used there seems to be little hope for unambiguous and conclusive reasoning on social and economic problems. Until the conditions which make this type of reasoning possible have been realised, we may expect each generation to repeat the social and economic mistakes of the preceding generation.

This then is the suggestion of modern physics "to those who would not go round in an eddy of purposeless dust," the suggestion that we extend to human experiences those methods of description, interpretation and correlation which have proved so effective in the physical and biological sciences, the suggestion that we have not less but more science. As we see it here "lies the path of advance to a clear purposed goal but it leads up a long steep journey." Its appeal lies in its certainty and its challenge to the best collective and co-operative thinking which can be achieved through the progressive development of the human mind. Through it and it alone we may realize the hope of Henley,

"I am the master of my fate,
I am the captain of my soul."

AUTHOR'S ABSTRACTS AND BRIEF ARTICLES.

A. THE SECTION OF ZOOLOGY.

DR. DWIGHT M. DELONG, Ohio State University, Columbus, Ohio,
Vice-President.

Temperature and the Heart Beat in Caddis Fly Larvae:—By HENRY FEDERIGHI, Antioch College, Yellow Springs, Ohio.

The temperature characteristics for the rate of heart beat in the caddis-fly larvae *Psilotreta* are u = 12,500 and 13,500, values which are indicative of activities probably controlled by the central nervous system. Analysis of data on the relation between temperature and the rate of heart beat in twenty-five invertebrates indicates that the value u for heart beat depends on the functional relationship between circulatory and respiratory systems.

Ecology of Ohio Band-Winged Grasshoppers: Orthoptera, Acrididae, Oedipodinae:—By E. S. THOMAS, Ohio Archaeological Museum, Columbus, Ohio.

These attractively colored insects are without exception xerophilous and geophilous. They are characterized by protectively colored tegmina and bright-colored wings. All have the ability of producing at will a crackling sound when on the wing, and, in addition, a stridulation while on the ground, by rubbing the hind femora against the roughened intercalary vein of the tegmina.

Four species winter in the nymphal stage, (our only species of grasshoppers to do so), the remainder wintering in the egg. All Oedipodinae lay their eggs in the soil.

Two explanations may be given of the significance of the bright wings in the economy of the insects: (1) Vosseler has suggested that the protectively colored tegmina and bright-colored wings constitute a contrast mimicry; (2) they may serve as a means of signalling or attracting the attention of other members of the community.

Three of the Ohio species are meso-xerophilous, inhabiting situations where the vegetation is relatively dense. The remaining 13 are xerophilous, some of them highly so. Five species occupy old fields and dry, upland pastures; 3 are found on eroded slopes and washes; 2 inhabit "dry prairie;" 2 are thamnophilous or even sylvan to a greater or lesser extent, and 3 are arenicolous, being found on sand dunes, sand bars along streams and sandy fields, respectively. Dissosteira occupies a wide range geographically and ecologically, but always xeric situations.

Observations on Two Nests of the Black-throated Green Warbler:—By MARGARET MORSE NICE, Columbus, Ohio.

Two nests of *Dendroica virens virens* were watched in Pelham, Massachusetts, in July and August, 1931. The first female during the two last days of incubation incubated for periods ranging from 34 to 50 minutes, absenting herself for periods ranging from 9 to 26 minutes. The second female once incubated for 99 minutes at a stretch; her absences varied from 13 to 20 minutes. The three young in the first nest were raised with no assistance from the male until the last two days when he brought 11 meals in contrast to his mate's total of more than 245 in 80 hours. The two young in the second nest were raised entirely by the female.

Both females fed at slow rates, the average for the first being once in 19.7 minutes, for the second once in 16.3 minutes. The young left at the age of 8 and 9 days. The male of this species possesses extraordinary energy for singing; the warbler of the first nest gave 466 songs in a single hour and 13,962 in the 94 hours of observation.

A Preliminary Report on the Food Habits of the Barn Owls at Ohio Wesleyan University:—By ARTHUR STUPKA, Ohio State University, Columbus, Ohio.

One year ago the writer collected 637 Barn Owl pellets in the attic of Merrick Hall, on the campus of Ohio Wesleyan University. These, upon examination, yielded a total of 2,000 skulls—chiefly skulls of mice and of such other smaller mammals as fall prey to these raptorial birds. Skulls from other pellets collected at the same time in the belfry of Gray Chapel, on the same campus, brought the total number examined to 2421.

A summary of this examination is as follows:

Six species of mice made up 75 percent of the food of the Barn Owls at this locality, twenty-one percent consisted of two species of shrews, two percent consisted of other small mammals, and two percent consisted of small birds.

A Study of the Large Banana Spiders:—By ROBERT L. BAIRD, Oberlin College, Oberlin, Ohio.

These large Tarantulas are commonly feared and regarded as deadly as rattlesnakes. But these kept in captivity have been handled freely without trouble. They have fed on grasshoppers, crickets, cabbage butterflies, a mouse that had been killed and given them, a large cecropia moth. Live mice have been put in with them, but they have done nothing with them. Once they have fed on night crawlers. Some have experimented further and had themselves bitten by them. None that come here in bananas seem to be dangerous. The Black Widow is the only North American spider that may be dangerous and it is a very sluggish one, almost impossible to make bite. From actual personal experience I know of no deaths resulting from its bite. Spiders are often blamed for human ills with which they have no connection. Apparently the only remedy needed is to hold the bitten member in

hot water or if aches have spread through the body to take frequent hot baths. It is not at all necessary to cut out the wound or bleed it.

Growth in Daphnia Magna:—By BERTIL GOTTFRID ANDERSON, Biological Laboratory, Western Reserve University, Cleveland, Ohio.

Observations as to the number of pre-adult instars have been made on over 200 individually reared female *Daphnia magna* of seven clones. In all cases measurements of the total length during each instar were taken. For well over a hundred individuals measurements of carapace length and height were taken in addition to those of total length.

The number of pre-adult instars varied from five up. This variation was found in all clones tested.

Growth curves have been constructed for various groups based on the number of pre-adult instars. The inflection in the growth curve of any dimension in any group coincides with the time of sexual maturity.

"Brooks' Law" of growth holds only for those groups which were primiparous during the sixth instar and then only approximately.

Relative growth in the dimensions studied follows the law $y = bx^k$. Relative growth changes at sexual maturity, i. e., a change occurs in the values of the constants b and k.

Notes on Macrobrachium (Palaemon) ohionis—Large Freak, Water Shrimp:—By ROBERT N. MCCORMICK, Ball State Teachers College, Muncie, Ind.

A relatively little-known shrimp, large enough to be of economic importance, exists in certain portions of the Mississippi River and its tributaries. It is locally used as fish bait and is marketed as human food. Throughout a part of this drainage system, this species apparently replaces the crayfishes. It was described in 1873 as *Palaemon ohionis* by Sidney I. Smith, from specimens sent from the Ohio River. Stephan A. Forbes, in the first Bulletin of the Illinois State Laboratory of Natural History, 1876–83, listed this form and left a note as to its distribution and variation in size. It has appeared in the diagnostic keys of Kingsley, of A. E. Ortmann and of H. S. Pratt, but to our knowledge, no figure of it has been published.

Dr. Waldo L. Schmitt, after a study of African Collections, has placed this shrimp in the Genus Macrobrachium.

The present study has been based on various collections from the Mississippi River near Chester, Illinois, material from Louisiana, observations of the live specimens after a year in captivity, and also of these very transparent living organisms under a binocular microscope.

On Eucrangonyx mucronatus Forbes: A subterranean, Blind Shrimp now Reported from Ohio:—By S. R. WILLIAMS, Miami University, Oxford, Ohio.

This fresh-water crustacean was first reported by Forbes from wells and springs of McLean County and Champaign County, Illinois, in 1876. O. P. Hay found it in an old well in Marion County, Indiana, in

1879 and in 1931 it was pumped from a well on the Francis farm in Ross Township, Butler County, Ohio.

An inspection of the glacial maps shows these localities are all close to the boundary of the Wisconsin, or last glaciation.

The question as to whether an animal goes into a subterranean habitat and then loses its sight by disuse or whether the creature, already a blind form, finds itself in the darkness and stays there because adapted to a cave life, seems definitely settled in the case of this eugrangonyx. Each isolated locality in which it may be discovered is a cumulative proof that the species, an inhabitant of deep, therefore dark and cool water and already blind, was left in underground passages in front of the melting glacier and in those spots where there has been a sufficient supply of food and of cool water has persisted through the fifteen to twenty-five thousand years since the final retreat of glaciation.

The logical inference would be that far north this same species should still be an inhabitant of deep, dark, cool places in the surface water.

Food Habits of Some Ohio Raptorial Birds:—By ARTHUR STUPKA, Ohio State University, Columbus, Ohio.

In November of the past year the Ohio Division of Conservation started a campaign against the wild-life predators of game birds and game mammals. Two methods were employed, namely, shooting and pole trapping. In an effort to obtain as much information as possible regarding all raptorial birds taken during the course of this campaign, the Bureau of Scientific Research sent word to all its game protectors to send all hawks and owls to the Ohio State Museum where it was the work of the writer to examine their stomach contents. To date 693 raptorial birds, representing 14 species, have been received.

The stomach contents of a great majority of the birds examined showed them to be of real economic benefit. Of 693 stomachs examined, 12 contained game birds, 17 contained poultry, 92 contained other birds, 285 contained mice, 53 contained shrews, 19 contained rabbits, 20 contained other mammals, 2 contained snakes, 16 contained crayfish, 6 contained spiders, 44 contained insects, and 206 were empty.

Pole trapping will cease in the state on June 1. Abolishment of the bounty system, elimination of the mythical "blue hawk" and "chicken hawk" from the list of unprotected birds, and strict supervision of any pole trapping are recommendations which the results suggest.

The Fresh-water Medusae of Vermillion River, Ohio:—By ROBERT L. BAIRD, Oberlin College, Oberlin, Ohio.

Two objects in this paper: To record the findings of the Fresh-water Medusae in Vermillion River, Ohio, September 14, 1930, by Robert Helfer, a West High School boy of Cleveland, Ohio; and secondly, thus to emphasize the importance of helping junior or amateur naturalists and encouraging them in every way possible. There are two previous Ohio records. The first was reported by Dr. R. C. Osburn, Head of the Zoological Department of Ohio State University, in Sep-

tember, 1926, when the animals were first found by Charles Cooper, Jr., of Coshocton, Ohio, a high school boy. The third was made by students of Ashland College. These were found in a quarry near Ashland, in September, 1930. A fourth record is just reported through the presenting of this paper and has been verified. Roger Conant, Educational Director of the Toledo Zoological Society, found them in a quarry near Toledo, October 6, 1931.

Most of the specimens have been lost. They may be satisfactorily preserved by first numbing them by dropping a few crystals of menthol in the water or crystals of chloral hydrate till the animals cease to move and then adding enough 40% solution of formaldehyde to make a 3% solution. All the specimens found in these records have been females.

A Cytological Study of the Glandular Epithelium of Lumbricus:—By THURLO B. THOMAS, Oberlin College, Oberlin, Ohio.

A study has been made of the cytology of the gland cells in the epidermis of *Lumbricus terrestris* on living and fixed material. For the most part the observations were confined to the 5th, 6th and 7th segments where the cells are much taller than in the stomach-intestine region. It is concluded that (1) with the possible exception of strictly sensory cells, any cell in the skin of these segments may produce mucous; (2) the gland cells do not contain fat; (3) both the small and large globules are stages in the production of mucous rather than being two types of glands as reported by former workers; (4) the mucigen granules arise as aqueous vacuoles stainable vitally with neutral red and become more concentrated by absorbing materials from the cytoplasm. It is suggested that either all or a part of the lipoidal material in both the mitochondrial and diffuse lipoids is utilized in the synthesis of the glycoprotein mucin.

The Reactions of Certain Cladocera to Colored Lights of Equal Intensity:—By HYMEN LUMER, Western Reserve University, Cleveland, Ohio.

Numerous investigators have studied the reactions of Daphnia to colored lights obtained by means of either a prismatic spectrum or colored media, and have found that the stimulating efficiency of the light increases from the violet to the red, green light having the maximum efficiency. In these experiments, however, no attempt was made to eliminate accurately effects which might be due to intensity differences. Moreover, scarcely any work has been done on other cladocera.

In our experiments, colored lights were obtained by means of a series of thirteen filters of known wave-lengths and energy transmission. For each filter, the source of light was placed at such a distance that the intensity of the light striking the animals was the same in all cases. Four species were investigated—*Daphnia pulex*, *Daphnia magna*, *Moina brachiata*, and *Leptodora kindtii*. The animals were exposed to the series of lights, and the number positive to the light counted after each exposure. The percent of the total number positive to each color was then determined.

It was found, in harmony with previous results, that the stimulating efficiency increased from the violet to the red. The maximum, however, was found to occur in the orange (620–640 $\mu\mu$), not in the green, although for *Moina brachiata* the efficiency of the two colors was about equal. This discrepancy is most probably due to the fact that colors equal in intensity were used here, and not in previous experiments.

The curves for the distribution of stimulating efficiency, although essentially similar, differ in certain details, indicating that the photochemical substances present are specific, although fundamentally alike. It is interesting to note that the curves most alike are those for *Daphnia pulex* and *Leptodora kindtii*, which are the least closely related of the species investigated.

The Phaenogenetics of Drosophila funebris:—By WARREN P. SPENCER, College of Wooster, Wooster, Ohio.

The genetic picture of *Drosophila funebris* differs markedly from that of other species of Drosophila which have been investigated. Of the approximately seventy visible mutants known, 58% affect the wings in shape, size and venation and about 28% are bristle mutants. There is only one eye color mutant in the list. In *Drosophila melanogaster* wing mutants are 25% of the total and bristle mutants about 12%. Color mutants are 36% of the total in melanogaster as against less than 2% in funebris. The dominants in *D. funebris* make up 40% of the total visibles while in melanogaster they form approximately 29% and in hydei 20%. Character expression of 60% or more of the funebris mutants is very variable with many normal overlaps. This is not the case with other Drosophila species. Temperature has been shown to affect the grade of expression of a number of the funebris mutants. The species is poorly adapted to studies on linkage, but excellent material for the investigation of gene manifestation in terms of environmental variables.

The Effect of Strychnine Sulfate upon the Melanophores of Eupomotis gibbosus:—By GEORGE RUGGY, College of Wooster, Wooster, Ohio.

In an attempt to throw some additional light upon the subject of the control mechanism of the melanophores of fishes, a series of experiments were undertaken to find out the effect of strychnine upon these cells. Experiments were made upon the isolated melanophores by placing them, contracted and expanded, in a graduated series of solutions of strychnine sulfate in normal saline. They showed no reaction. Then this same series of solutions were injected intraperitoneally into three-inch specimens of *Eupomotis gibbosus* (the common sunfish) and peculiar reaction of the melanophores was observed. It consisted of rhythmic contraction and expansion of the melanophores and was called a "wave phase." It seemed due to the lowering of the synaptic resistance which is the characteristic effect of strychnine.

It was concluded that the melanophores are pre-eminently under the control of the sympathetic nervous system.

Winter Feeding of Game Birds:—By LAWRENCE E. HICKS, Ohio State University, Columbus, Ohio.

Upland Game Bird research studies in Ohio conducted for the Ohio Division of Conservation have been carried to each township of the 88 counties of the state. An ecological survey is being made in an attempt to (1) evaluate the possibilities of each area for the several game birds and related species involved, (2) make an analysis and comparison of habitats found, (3) make a summary of all biotic changes taking place which might affect game birds and (4) correlate the abundance and distribution of each species in relation to geological divisions, ecological types and specific man-induced conditions.

With this information it is hoped to (1) estimate eventually rather accurately the ability of any given land area to produce game of a certain species under present conditions, (2) estimate the possibility of increasing the game production ability of a particular area by man control of many environmental conditions (management), and (4) to determine what steps will be necessary to increase most efficiently land game bird production capacity with the least expenditure of time, effort, and money and the least interference with agricultural and forestry activities.

During the winter of 1930-31, 20 winter feeding stations were established in central and northwestern Ohio. Studies at these stations aided greatly in the solution of many of the problems outlined above. These feeding areas covered 4,125 acres of land and a total of 2,702 game birds were fed, including 1,869 Ring-necked Pheasants, 605 Bob-white, 228 Hungarian Partridge and several hundred smaller birds. Topics studied were necessity of feeding, desirability of various foods and cover, mortality, sex ratios, fluctuations in numbers, etc.

Winter feeding and management studies have made it possible to develop a Ring-necked Pheasant refuge policy which it is hoped can soon be put into operation. Such a plan is workable and relatively inexpensive, as has already been shown by experiment and is the only plan which will supply game birds in numbers sufficient to meet the excessive demands.

B. THE SECTION OF BOTANY.

DR. ARTHUR T. EVANS, Miami University, Oxford, Ohio,
Vice-President.

The Forests of the Illinoian Drift Plains of Southwestern Ohio.—By E. LUCY BRAUN, University of Cincinnati, Cincinnati, Ohio.

The area considered consists of the flat and undissected portions of Clermont, Brown, Warren, Clinton and Highland counties in southwestern Ohio—the area of the Illinoian drift. The Clermont silt loam or "white clay" is the prevailing soil; other types are recognized, though less extensive. Topographic development and successional

stage affect the composition of the forest. In second growth forests, pin oak is dominant. In primary stands, several distinct associations are distinguished and related in part to water content of soil and soil differences. The probably post-glacial development of the forests of these areas is outlined, with evidence offered from distribution of communities around depressions, from secondary succession, and from the geographic distribution of certain characteristic species of the area.

An Instrument for the Accurate Quantitative Determination of Chlorophyll:—By R. E. OLTMAN, Oberlin College, Oberlin, Ohio.

Because the colorimetric method of chlorophyll estimation fails to detect slight differences in chlorophyll concentration, and the spectrophotometric method involves the use of apparatus not always available to botanists, the present apparatus has been devised. A light beam of unvarying intensity is converted to wavelengths approximating those of the absorption bands of chlorophyll, by means of a colored slide. The light beam passes through an absorption cell containing a solution of the potassium salt of chlorophyll, upon the face of a photo-electric cell, which registers the intensity of the beam upon a sensitive microammeter or galvanometer. The preparation of chlorophyll for use in the apparatus is described, and lantern slides employed, illustrating the calibration of the instrument. The instrument is easily constructed at a cost of less than $30.00 for parts and materials.

The Effect of Ultra-violet Light of Various Wavelengths on Pigmentation and Growth of Bean Seedlings:—By R. E. OLTMAN, Oberlin College, Oberlin, Ohio.

By means of Cellophane filters soaked in organic compounds, several cut-offs in the ultra-violet are procured. A G. E. S-1 lamp is used as the ultra-violet source, and bean seedlings treated with filtered and unfiltered ultra-violet light. The pigments are extracted and the concentrations, as developed under different wavelengths of ultra-violet, are measured and contrasted. Results indicate a considerable increase in chlorophyll concentration is effected by unfiltered light from an S-1 lamp, while varying degrees of increase over normal pigment concentration are effected by filtered ultra-violet. Controls are grown under an ordinary Mazda lamp, whose visible light energy is adjusted to equal that of the S-1 lamp. Results indicate that many of the effects upon growth of plants, attributed to ultra-violet light, are due merely to an increase in the amount of *visible* light supplied by the ultra-violet source. Quantitative determination of chlorophyll is effected by means of the instrument described in the preceding paper. To be illustrated with lantern slides.

C. THE SECTION OF GEOLOGY.

PROF. E. M. SPIEKER, Ohio State University, Columbus, Ohio,
Vice-President.

The Stolons of the Trepostomata:—By GEORGE B. TWITCHELL, 845 Dayton Street, Cincinnati, Ohio.

Zoarial stalks in many encrusting organisms appear as recumbent individuals which subsequently become erect. Where buds arise serially from bases of stalks, the recumbent portions, following one another, suggest that the stalks may have arisen from stolons.

A true stolon, however, is not formed in this way. A true stolon forms a zoarial bud at its growing tip, but its growth continues beyond the zoarial stalk produced to form a base (stolon) for the next stalk.

It is in the Entoprocta, among living bryozoans, that we find such stolons. Here the stolons are divided into segments by perforated diaphragms with the zoarial stalks arising from their middles.

It has generally been accepted that the Trepostomata budded and formed new stalks, like the Cyclostomata, without the formation of true stolons. This idea has received strong support from the work of Cumings. What I expect to present to you here is that the Trepostomata, at least most of them, arose from true stolons and that these stolons had the characteristics of the stolons of the Entoprocta.

Wherever Trepostomata arise from a so-called epitheca, sections show that the epitheca is made up of tabulated tubes, stolons. A similar arrangement can be found when the bryozoans are attached and no epitheca apparent.

Acanthopores are common in the early immature region and are not limited to the mature region. This occurs on the stalks much as spines occur on Pedicellina echinata. The wall pores and spines of the Entoprocta are relics of the acanthopores of the Trepostomata.

A Possible Pseudobornia from the Ohio Shale:—By WILLARD BERRY, Ohio State University, Columbus, Ohio.

A remarkable long branch and stem or stem and rhizome collected from the lower three feet of the Ohio Shale as exposed at High Banks on the Olentangy River north of Worthington, Ohio, and referable to *Pseudobornia inornatus* (Dawson) White is identified as *Callixylon newberryi* (Dawson) Elkins et Wieland as that species is interpreted by Arnold.

Base Saturation as an Indication of the Extent of Teaching in Surficial Materials:—By G. W. CONREY, Ohio Agricultural Experiment Station, Wooster, Ohio.

It is the common practice to determine the extent of leaching in surficial materials, by a determination of the depth to carbonates, as indicated by effervescence with acid. This shows the depth to which carbonates have been removed from the soil, but tells little or nothing about the condition of the material above. The reaction of surficial material expressed as the pH value has also been used as an indicator.

As surficial materials weather there is developed a complex capable of absorbing bases. In the calcareous soil this complex is saturated with bases, but after the carbonates are gone there continues to be a removal of base from the absorbing complex and a substitution of hydrogen. The relation of the amount of bases absorbed to the total capacity to absorb bases is spoken of as the degree of saturation. As soils become more leached, they become less saturated with bases, and more saturated with hydrogen. Data is presented to show the extreme low degree of saturation of soils derived from the Illinoian drift as compared with the Late Wisconsin drift in western Ohio. Both soils are non-calcareous, although the parent material is high in lime. Considerable areas of drift in northeastern Ohio are naturally non-calcareous, being derived from sandstone and shale which contain little or no carbonates. The extent of leaching is well expressed by the degree of saturation.

Salient Features of the Appalachian Valley in Virginia:—By ARTHUR BEVAN, Virginia Geological Survey, University of Virginia, Virginia.

The Appalachian Valley and Ridge province occupies all of Virginia west of the Blue Ridge province, except the extreme southwestern part of the State which is in the Appalachian Plateaus. The Valley in Virginia is almost 400 miles long in a southwesterly direction, about 25 to 50 miles wide, and contains approximately 10,000 square miles. Its southwestern tip is at the longitude of Toledo, Ohio.

The Valley contains, according to the recent work of Butts and Ulrich, probably about 40,000 feet of Lower Cambrian to Upper Mississippian (Chester) sedimentary rocks. Single shale and limestone masses are a few thousand feet thick. The basal part of the section is dominantly sandstone, the lower middle part is mainly limestone and dolomite, the upper middle part is chiefly shale, and the upper part is shale and sandstone with considerable limestone in the southwest part of the Valley.

The structural pattern comprises (1) many large pitching anticlines and synclines, having in general a northeasterly strike and being overturned to the northwest; (2) numerous great overthrust faults, overriding to the northwest; (3) numerous fensters; and (4) scattered klippen. The horizontal displacement along some faults is probably of the order of several miles to a few tens of miles and the stratigraphic displacement in places causes Middle Cambrian to overlie Upper Mississippian or even Pottsville rocks. One overthrust is known to extend from Tennessee for more than 200 miles in Virginia. These features have been worked out mainly by Butts, Campbell, Holden, Stose, and Woodward.

Post-Paleozoic erosion has produced a recorded series of five erosion levels; the upper two being prominent on the long, linear, even-crested mountain ridges, and the next to the last one being conspicuous as the extensive trenched Valley-floor. Physiographic salients have been worked out chiefly by Stose and Wright. Many drainage peculiarities have been developed. Underground drainage and numerous large spectacular caverns are characteristic of certain belts of limestone.

Pre-Cambrian Geology in Central Virginia:—By A. S. FURCRON, Western Reserve University, Cleveland, Ohio.

This paper will discuss the structural, stratigraphic and perrographic features of pre-Cambrian geology in central Virginia. A brief outline of the history of the study of crystalline rocks in this part of the State will be given which will include a summary of present knowledge. It will contain an interpretation of present pre-Cambrian problems based upon the recent writings of geologists who have made a study of this region and upon a study by the writer of about 800 square miles in the Piedmont Plateau and Blue Ridge provinces. The paper will be illustrated by monochromes and autochromes.

Solution Phenomena in the Basal Oneota Dolomite:—By WM. A. P. GRAHAM, Ohio State University, Columbus, Ohio.

The lower contact of the basal dolomite bed of the Oneota formation of Minnesota is sometimes found to be very irregular. Where these irregularities are developed the dolomite is strongly jointed. Settling of the overlying dolomite, following solution, has resulted in the deformation of the underlying clastic material.

Glacial Limestone Deposits Near Mt. Liberty, Ohio:—By RICHARD C. LORD, Kenyon College, Gambier, Ohio.

In southeastern Morrow County and southwestern Knox County near Mt. Liberty, Ohio, is an area some six miles by one-half mile where the glacial till contains in certain places an accumulation of pieces of limestone, up to two or three cubic feet in size.

Three out of four analyses of sample pieces were dolomite, the fourth a limestone containing nineteen percent magnesium carbonate.

This occurrence of limestone in glacial till indicates that the ice by which these were carried passed over the Monroe (dolomite) and lower Devonian (limestone) west and northwest of this glacial deposit in its course.

The movement of the last ice sheet in this locality was thus in an easterly or east-southeasterly direction.

Between 1820 and 1860 this accumulation of limestone boulders by the ice was used to obtain lime for building purposes by local burning of the lumps of limestone.

Pre-Cambrian in Ohio:—By GEORGE D. HUBBARD, Oberlin College, Oberlin, Ohio.

Many well drillings over nearly all parts of Ohio reveal a rather orderly succession of strata. Three or four wells have gone through the sediments to pre-Cambrian rocks. These testify to the form of the surface upon which the Cambrian rock sediments were laid.

Pre-Cambrian, where exposed, shows complex rock structure and often considerable mineral wealth—iron, nickle, cobalt and some gold and silver. Torsion balance and other methods of physical surveying at the surface have shown their usefulness in detecting geologic facts beneath a mile or more of sediments, especially when so uniformly

laid as ours are. Perhaps a survey by geophysical methods over the western half of Ohio would be worth while.

Net-work Passages and the Origin of Limestone Caverns:—By A. C. SWINNERTON, Antioch College, Yellow Springs, Ohio.

The two-cycle theory of cavern formation in limestone proposed by William Morris Davis finds a measure of support in the presence of looped and net-work passageways in many caves. Recent investigations in the Mammoth Cave region suggest ways in which such openings may be reconciled with other theories of cave origin.

The Caves of Yarim Burgaz, Turkey:—By GEORGE D. HUBBARD, Oberlin College, Oberlin, Ohio.

Caves about 12 miles west of Istanbul made before the recent small submergence have passed the enlarging stage and entered the filling stage as many stalactites show. But the drip goes down to lower levels not yet seen, indicating that a new system is being formed below the known one. Bats are common in the cave. Two green salamanders were taken in the first chambers. The main cave has been used for human residence and for burial, as shown by three graves, one-fourth mile from the entrance and two near the entrance. These are prehistoric. Shepherds have used it also in modern times.

Some Features in the Drainage History of the Upper Ohio:—By G. F. LAMB, Mount Union College, Alliance, Ohio.

The preglacial northward drainage of the Upper Ohio has long been established. Late Tertiary and early Pleistocene stream grades were at high levels with distinctly lower levels at later glacial stages. The East Liverpool-Beaver section affords a key area and presents three distinct stream levels and deposits of as many glacial stages—Wisconsin, Illinoian, and an older stage of Parker Strath time or older. After early glaciation the temporarily diverted Upper Ohio returned to the Erie basin, cutting the deep inner channel before the Illinoian invasion. This latter ice sheet permanently reversed the Upper Ohio.

Abnormal drainage features south of the New Martinsville divide point to a progressively northwest shifting divide with striking stream captures that were in progress before the glacial epoch.

Drainage Changes of the Upper Mahoning River:—By ROBERT SCRANTON AND G. F. LAMB, Mount Union College, Alliance, Ohio.

Findings in a recent study of the drainage of the upper Mahoning River appear to reveal a somewhat complicated history. It has been thought that the present Mahoning follows essentially its preglacial course to its junction with the old Pittsburgh River near Leavittsburg. Field data indicate that the preglacial upper Mahoning was not a tributary to the old Pittsburgh River, but followed a course from Alliance to Ravenna, passing near Kent, then northward through the Chagrin River Valley and into the Erie basin, thus draining a distinctive area lying between the Cuyahoga basin on the west and the Grand River

basin on the east. It is thought that the deep channel was cut in interglacial time prior to the Illinoian invasion, that with the Illinoian advance the drainage was diverted eastward at Ravenna into the reversed Pittsburgh River, and that all the upper Mahoning held this drainage line until the Wisconsin invasion, and after this invasion took the course now occupied from Alliance to Leavittsburg.

D. THE SECTION OF THE MEDICAL SCIENCES.

DR. SHIRO TASHIRO, University of Cincinnati, Cincinnati, Ohio,
Vice-President.

The Effect of Various Stimuli on the Basal Metabolic Rate, the Blood Pressure, and the Galvanic Skin Reflex in Man:—By E. ROWLES AND J. R. PATRICK, Ohio University, Athens, Ohio.

Using the Benedict-Roth basal metabolism apparatus, the Tycos sphygmomanometer with a reducing capsule and tambour attached, and the Hathaway psychogalvanometer with a Ruckwick photographic apparatus attached, the experimenters ran a series of control tests, first basal alone, second, with sphymomanometer and other apparatus attached and operating. After several records under normal conditions were taken the subjects were subjected to various stimuli of a "sensory" and "ideational" nature to note the effect of these stimuli on the basal metabolic rate, the blood pressure, and the galvanic skin reflex. Male college students, with one exception, were used as subjects under rigidly controlled conditions. The results so far obtained from this preliminary investigation seem to show: (1) that all subjects, with one exception, show an increase in the basal metabolic rate above the normal and the control rates of 9% to 38% when subjected to various stimuli which supposedly have an emotional effect; (2) blood pressure changes occur following the application of most of the stimuli; (3) while the data is not as complete on the galvanic skin reflex, the data that has been secured shows a deflection of varying degrees following the application of the stimuli; (4) whether the peripheral changes occur first, later followed by more deep-seated changes as cardiac and metabolic, have yet to be determined more precisely, or again, whether this technique will differentiate the effects of the various stimuli is yet to be determined.

The Ultra Violet Absorption Spectra of Vitamin B Concentrates as Correlated with their Potencies:—By FRANCIS F. HEYROTH AND J. R. LOOFBOUROW, University of Cincinnati, Cincinnati, Ohio.

The preparation of three vitamin B (chiefly B_1) concentrates from yeast is described. In biological tests by the M. I. Smith rat curative method, which is discussed critically, H_1 proved relatively inactive, H_2 cured the symptoms described in a minimal dose of 0.04 mg., and H_3 in one of 0.16 mg.

The ultra violet extinction coefficients of these and other concentrates kindly furnished by Drs. A. Seidell and L. R. Cerecedo, have been determined and a series of curves plotted. All show evidence of the type of absorption previously attributed to pyrimidines or irradiated pyrimidine-containing materials. The attempt is made to correlate this absorption at various wave-length regions before and after correcting for the possible presence of nucleic acid, with the relative potencies of these samples. It is probable, although not proved, that the biologically active material may absorb between 2300 and 2500 A°.

A Physiological Mechanism in Control of Blood Coagulability:—By DON D. IRISH, University of Cincinnati, Cincinnati, Ohio.

Tissue extracts and their decomposition products which affect coagulability in vivo owe their action to a physiological mechanism. The spleen is the organ which reacts to these materials as they are inactive in the absence of the spleen. The response of the spleen is manifest as a sharp increase in the number of platelets per cu. mm. of blood. Splenectomy is followed by a high platelet count which falls to a base level in about two weeks. It remains at this base level indefinitely, showing none of the erratic changes of the normal and unaffected by materials mentioned above. The spleen acts as a reservoir for platelets and may be called upon in an emergency to produce a great increase in their number and produce it quickly.

On the Chemistry of the Hinton Test for Syphilis:

(1) *Nature of the Muscle "Antigen:"*—By SHIRO TASHIRO, University of Cincinnati, Cincinnati, Ohio.

The general method of the preparation of "antigen" in various precipitation tests for the diagnosis of syphilis and the particular technique used in the Hinton test suggest that "antigen" might contain a bile salt. The results of chemical and physiological analysis support the idea and further suggest that the presence of a bile salt plays an essential part in all the precipitation tests.

(2) *A Synthetic "Antigen."*—By MISS CHRISTINE M. VACK, University of Cincinnati, Cincinnati, Ohio.

The antigenic properties of various known mixtures of lecithin, cholesterol, and bile salts were investigated in syphilitic sera. The Hinton technique was used. Lecithin was found to be essential for the reaction, but increments of lecithin, when bile salt and cholesterol concentrations were constant, did not increase the specificity of the test. On the other hand, increments of bile salt, when lecithin and cholesterol concentrations were constant, increased the specificity in direct proportion to the amount of bile salt used. Neither variation of cholesterol content or the percentage of glycerol in which the antigen was made up, increased the specificity of the test. Addition of a small amount of urea to a synthetic antigen increased the ease of reading, and eliminated false weakly positive reactions.

Hematoporphyrin, an Artificial Proteolytic Enzyme:—By M. J. Boyd, University of Cincinnati, Cincinnati, Ohio.

Enzymes are conductors of energy. Hematoporphyrin in the presence of light energy has a digestive action on the blood proteins, fibrinogen and serum albumin with the production of hydrolytic products. The striking fact is that oxygen is necessary for the proteolytic action of this artificial enzyme.

The Absorption and Excretion of Lead in Primitive Life:—By Robert A. Kehoe, University of Cincinnati, Cincinnati, Ohio.

The question of the presence of lead as a normal constituent of living organisms has been investigated in a study of certain primitive agricultural communities. The general methods of study and the results obtained are presented briefly.

Photographs of the experimental subjects and their environment are used to illustrate the primitive character of the communities.

Vaccine in the Prevention of the Common Cold:—By W. E. Brown, M. D., University of Cincinnati, Cincinnati, Ohio.

An experimental study was made to determine the effects of vaccination on the incidence and duration of common colds. Eighty medical students were vaccinated with a prepared, partially detoxicated vaccine and eighty-two medical students acted as controls. In order to have other evidence of immunity beside clinical manifestations three sets of skin tests were made on the experimental group, using heat killed antigens made from the organisms used in the vaccine. The first set of skin tests was carried out before vaccination, the second set was done thirty days after vaccination and the third set six months after vaccination. All tests were carefully checked and reactions were recorded as sensitive or non-sensitive.

Twelve daily inoculations (subcutaneous) with a partially detoxicated vaccine containing fifteen organisms recovered from respiratory secretions were given to the experimental group. Analysis of the two groups showed them to be comparable except that the control group had had a longer period of local residence and used cigarettes to a greater extent while the experimental group showed a greater incidence of sore throats, sinusitis and chronic coryza during the previous year as well as an alleged greater incidence of common colds with longer duration during the previous year.

The first set of skin tests showed thirty-three per cent non-sensitive to the antigens as a whole, while the reactions to the first dose of vaccine showed thirty-five per cent non-sensitive. The experimental group showed an increased sensitivity up until the 11th dose of vaccine, this being confirmed by the greater incidence and longer duration of colds in the experimental group, as compared with the control group, during the period of vaccination. Reactions to the 12th dose of vaccine indicated 55% non-sensitive, suggesting that sufficient vaccine had not been given. The mean dosage of vaccine was 2.23 cc. with five individuals having a single systemic reaction. The increase in dosage of the vaccine was too rapid for the group as a whole. The second set of skin

tests showed a combined percentage of 68% non-sensitive, thirteen per cent more than was shown by the final vaccine reactions. This may be explained by the development of immunity on the part of some individuals during the thirty days between the time of final vaccinations and the skin tests. The gain in the combined percentage of the non-sensitive as brought out by the second set of skin tests was thirty-five per cent. In the experimental group during the period of the experiment there was a mean number of colds of 1.85 with a mean duration of 7.4 days as compared with 2.17 and a mean duration of 7.6 days for the control group. This is not mathematically significant.

A twenty-five per cent loss of immunity acquired by vaccination was found in the experimental group six months after vaccination, as indicated by the third set of skin tests. Personal impressions of benefits derived from vaccination implied much better results than the actual figures justified. The higher degree of susceptibility to respiratory infections on the part of the experimental group must be considered, but cannot be evaluated mathematically.

The statistical results of the experiment show little, if any improvement as regards common colds in the experimental group as a whole compared with the control group. Individuals in the experimental group appear to have received some benefit. This is in accord with the findings that the group as a whole was not completely desensitized to the particular antigens used. Better results may be possible with an increased dosage of the vaccine.

On the Treatment of Tularemia with a Specific Antiserum:—By LEE FOSHAY, M. D., Christ Hospital Institute for Medical Research, Cincinnati, Ohio.

A specific antiserum has been prepared from the goat after immunization of the animal by subcutaneous injections of formaldehyde-killed suspensions of *Pasteurella tularensis*. This antiserum has proved to be of great benefit in the treatment of human tularemia, causing prompt recession of most of the clinical signs and symptoms, greatly shortening the course of the disease, and preventing suppuration of the involved lymph glands. It must be given early in the course of the infection to yield the best results. When so given the rapidity of clinical cure is quite astonishing.

Evidence is presented to show, at the present stage of development of the serum, that it is not bactericidal and that in amounts relatively far in excess of the satisfactory human dose it will not protect laboratory animals from death by infection with known virulent strains of *P. tularensis*. Its chief therapeutic benefit seems to be associated with its capacity to abolish the state of hypersensitivity that tularemic infection causes in man. The experience with it, in the first series of fifteen human cases, is presented.

The Metabolism of a Woman 106 Years Old:—By J. R. MATSON AND F. A. HITCHCOCK, Ohio State University, Columbus, Ohio.

A series of basal metabolism tests have been run on Mrs. Anna Burns, aged 106 years, a patient at St. Anthony's Hospital, Columbus,

Ohio. Her weight is 31.81 kilos and height is 147 cm. Blood pressure ranges between 170–90 and 140–80, pulse varies from 66 to 72. Arteries are sclerotic and her temperature subnormal. Blood sugar is low, 66 mg. per 100 cc. Wasserman is negative. Blood count and urinalyses showed nothing of significance. Body surface determined by the linear formula of DuBois was 1.13 sq. m.

Six tests made on the Benedict Roth apparatus gave the following averages: Tital air = 206.4 cc.; oxygen consumption = 81.0 cc. per minute; total calories per hour = 23.91; calories per hour sq. m. body surface = 21.16.

Average calories from food consumed was 919, an excess of 60% over 574, the basal requirement.

The table of normal standards does not extend beyond 80 years. The accepted figure for women of 80 is 33 cal. per hour per sq. m. of body surface. The results obtained on Mrs. Burns were 36% below this figure. For the 25 years of life between 55 and 80 the basal metabolism drops 12%. The results of this investigation indicate that the basal metabolism drops at an increasing rapid rate after the age of 80 is passed.

The Effects of Small Quantities of Ethyl Alcohol on the Respiratory Exchanges during Rest, Work and Recovery:—By ROBERT C. GRUBBS AND F. A. HITCHCOCK, Ohio State University, Columbus, Ohio.

This series of experiments has been carried out with a view of determining whether or not the energy derived from the oxidation of alcohol can be used by the muscles in doing work. Three male subjects were used and the respiratory exchanges were measured in basal and work tests. Control and alcohol tests were run alternately. In alcohol tests the subjects took 95% alcohol in quantities from 15 to 30 cc. diluted to 200 cc. with tap water. In control tests, 200 cc. of tap water were usually taken. The alcohol produced a significant lowering of the respiratory quotient both in basal and work tests. The oxidation of alcohol which was attributed to muscular work was calculated from the lowering of the non-protein respiratory quotient in the work tests. From the results obtained the authors conclude that the alcohol can be used in the performing of muscular work.

Acceleration of the Ulcer Producing Action of the Bile Salts:—By L. H. SCHMIDT, University of Cincinnati, Cincinnati, Ohio.

Feeding of thyroxin increases the susceptibility of guinea pigs to the ulcer producing action of the bile salts. This increased susceptibility is proportional to the amount of thyroxin administered. Experiments on the effect of thyroxin feeding on the blood and tissue phospholipids of the rabbit suggested that the increased susceptibility is due to a decrease in the phospholipid content of the blood and certain tissues. This suggestion is supported by the fact that the amount of phospholipid required to protect the thyroxin fed animal is two and one half times as great as the amount required to protect the normal animal from the same dose of bile salt. Diphtheria toxin

also increases an animal's susceptibility to bile salt ulcer—the facts indicate that the mechanism has points of similarity.

Ulcers produced by bile salt injection, alone, or following thyroid or diphtheria toxin treatment are much too acute to bear any striking resemblance to the acute human gastric ulcer. These ulcers never occur unless the treatment is so severe as to kill the animal. Recent experiments have shown that the combination of very small doses of bile salt with oleic or stearic acid results in the production of gastric ulcer, without producing death. This ulcer is practically identical with the human acute ulcer. It is produced by one-fourth of the amount of bile salt required to produce ulcer alone, plus an equal amount of oleic or stearic acid. Twenty times the quantity of oleic acid used will not produce ulcer if injected alone. The possible significance of these facts in the production of human gastric ulcer is discussed.

Child Labor in the United States as Subjected to Poisons and Dusts:—By EMERY R. HAYHURST, Ohio State University, Columbus, Ohio.

A fact-finding inquiry into gainful employments of minors under 18 years of age exposing them to poisons and dusts. States showing chief concentrations; their laws; occupational diseases found. Present day trends. Evidence that minors are more susceptible than adults to poisons and dusts.

Data on Ventilation Conditions—A Field Neglected by the Physician (with demonstration of essential aerological determinations):—By EMERY R. HAYHURST, Ohio State University, Columbus, Ohio.

Summary of effects of room air conditions on physiological reactions. Evidence that American physicians neglect this subject in practice and research. Gold brick ventilation and air conditioning schemes. Protocols of some aerological determinations in various types of interiors. (Demonstration of essential instruments and methods).

Central Connections of the Eighth Cranial Nerve in the Guinea Pig:—By RUSH ELLIOTT, Ohio University, Athens, Ohio.

This report involves only the cochlear portion of the eighth nerve. Neurons begin in the cochlea, their cells of origin being in the spiral ganglion, and enter the brain at the junction of the medulla and pons, terminating in the dorsal and ventral cochlear nuclei. From these two nuclei secondary neurons pass dorsally and then ventromedially, forming the acoustic stria which separates into a lateral portion which joins the lateral lemniscus of the same side and a medial portion to join the lateral lemniscus of the opposite side. From the ventral nucleus arise fibers which follow a ventral superficial course, forming the trapezoid body, and decussating to join the lateral lemniscus and superior olivary nucleus of the opposite side. From the superior olive the olivary peduncle fibers synapse with the nucleus of sixth cranial nerve and join the median longitudinal fasciculus.

The lateral lemniscus carries on rostrally, many of the fibers synapsing along the course of the tract, the cell bodies of the neurons of the next higher order forming the nucleus of the lateral lemniscus. At the level of the inferior colliculus part of the fibers of the lemniscus terminate in the colliculus, while others with neurons which originate in the colliculus pass to the medial geniculate body, forming the brachium of the inferior colliculus.

Decomposition Products of Chlorophyll in a Herbivorous Animal and the Relationship of these Products to Haemin:—By PAUL ROTHEMUND, Antioch College, Yellow Springs, Ohio.

The C. F. Kettering Foundation for the study of chlorophyll and photosynthesis at Antioch College, Yellow Springs, Ohio, is especially interested in chlorophyll decomposition products occurring under normal physiological conditions. One of these products is the phylloerythrin in the bile and feces of herbivorous animals. The place of formation of this porphyrin was unknown to date. An investigation was undertaken with this object in view. The report contained a few aspects of the problem of naturally occurring chlorophyll decomposition products and a discussion of the chemical relationship of these substance to haemin, the red coloring matter of blood. Slides demonstrated the photosensitizing effect of porphyrins in the human and the animal body.

Brief summary of the experimental results of the investigation: Phylloerythrin occurs in the third stomachs of cows and sheep; traces were found spectroscopically in the first stomach. The substance was isolated in crystalline form and identified in the form of the methyl ester. Subcutaneous injection of phylloerythrin into guinea-pigs has a photosensitizing effect on these animals. The occurrence of phylloerythrin as a result of mild chlorophyll decomposition in the cow's stomach supports a formula for chlorophyll containing a five ring system added to the porphin structure.

A few more porphyrins have been found in the stomachs of the cow. Work is in progress to identify these substances.

Teaching Scientific Methods through Activities in Health Education:—By MRS. NORMA SELBERT, College of Medicine, Ohio State University, Columbus, Ohio.

Studies made last year, and also in 1928, to investigate the health habits of University Women, showed up the ineffectiveness of the superficial, abstract, courses in hygiene which have been taught heretofore.

During the past year experiments have been conducted with the intention of making the course entitled Public Health Problems in the Ohio State University practical. The aim has been to connect scientific instruction with conditions under which the student must sleep, eat, work, and play. Special effort has been put forth to teach each student how he can adjust himself to his environment, and how he may change undesirable habits.

Catalogue announcements of this course read as follows:

PUBLIC HEALTH PROBLEMS:—Five credit hours. One Quarter. Autumn. Winter. Spring. Four class periods and one field trip each week. Students provide their own means of conveyance on trips. Prerequisite, Chemistry 401 or 411, Physics 401 or 403, and five credit hours in college biological science; or a background in economics, or sociology, or education, or industrial engineering. A previous or concurrent course in bacteriology is recommended. Instructor: Mrs. Selbert.

A résumé of theories and discoveries pertaining to the causes and prevention of disease. An elementary consideration of the public health aspects of such problems as food supplies, water, sewage, refuse, ventilation, communicable diseases, maternity and infant welfare, housing and school hygiene, camp and rural sanitation, tuberculosis, cancer, goiter, quackery, mental and industrial hygiene, vital statistics, and health administration.

In the onset of each quarter, the instructor discussed various obvious public health problems, and spoke on the History of Public Health Services; and newer positions in the field of public health.

Each student then selected a public health problem which he or she studied throughout the quarter. The following pages were given to each person who registered for the course. (The pages were passed around during the meeting.)

Students were encouraged to create a way of life which enables them to keep the laws of health. To promote maximum and continuous growth was the aim in each personal undertaking. They were led to draw upon all available fields of knowledge and experience and to keep close check upon their own habits. They were led to develop a consistent and comprehensive view of life including facts about birth, marriage, morbidity, and death. They viewed their problems in the light of a mature outlook on life. Each student was asked often to define his, her outlook on life.

Conferences, and frequent association with superior persons, and specialists who excelled in fields concerned with their problems enabled each student to get a superior view of life and exact knowledge on his or her problem without having much organized class work.

The teachers function was to help the student in making appraisals of the knowledge he acquired. Life is the art of knowing what to relinguish and what to hold. The aim was to develop in each student an adequate view of life, to improve his personal health and behavior, to give him accurate knowledge about public health problems.

During the periods given over to hearing reports from investigations—all students in the class learned general facts about all of the problems listed. Each student also learned a lot about the one problem for which he expressed personal interest.

Some Observations on the Relation of Bodily Weight to the Mental Status in Schizophrenia (Dementia Praecox):—By CARL W. SAWYER, M. D., White Oaks Farm, Marion, Ohio.

An analysis is made of 175 cases of Dementia Praecox seen over a

period of twenty-six years and the relation of bodily weight to these cases.

Charts and diagrams were used to illustrate the facts as follows:

1. There is a decided shifting of weight in Dementia Praecox cases from the highest weight attained to the lowest reached. This is most pronounced in the one to eighteen pound range.
2. There is a decided shifting of weight in Dementia Praecox cases from the weight upon admission to the weight upon discharge. The most common range is from one to seventeen pounds. This range may be either a gain or a loss.
3. Recovery and improvement in Dementia Praecox cases is very definitely associated with a gain in weight. Conversely a patient who gains weight has over twice as many chances of recovering as one who does not and they have about four times greater chances of being improved than if they do not gain weight.
4. Dementia Praecox cases show an immature development so far as their weight is concerned.
5. The commonly accepted theoretical weight tables cannot be used as guides in determining the normal weights of Dementia Praecox patients.
6. Whether a Dementia Praecox case recovers or not does not depend upon the relation of their actual weight to their theoretical weight.
7. Decided loss of weight below the theoretical weight is of no significance so far as the beneficial outcome of the patient is concerned.
8. There is a definite relation between bodily weight and mental status in cases of Dementia Praecox; the mental status improves practically always with an increase of bodily weight.

The Effect of Various Salts and the Hydrogen Ion Concentration on the Length of Life of Asellus sp.—By E. ROWLES AND P. S. SHURRAGER, Ohio University, Athens, Ohio.

EXPERIMENTAL PROCEDURE.

1. Asellus were collected and brought into the laboratory conditions twenty-four hours before the experiments.
2. Stender dishes of 25 cc. volume, with ground glass lids were used.
3. Three males and three females were placed in K, Ca, Mg, and Na, of M/8, M/16, M/40, and M/80 concentrations.
4. Three males and three females were placed in a pH range of 2.97 to 8.55.
5. Experiments were observed on the antagonistic effects of these salts.
6. Controls were kept in distilled, tap, and pond water.
7. The Asellus were observed constantly until death, at which time they were removed from the solutions, dried on filter paper and weighed.

EXPERIMENTAL RESULTS.

1. The relative toxicity of the ions in the four concentrations used, showed: K > Ca > Mg > Na.
2. Within the male or the females, the lethal effect of the salts is inversely proportional to the weight.
3. Females died more readily than males in January; while the males died more readily than the females in March.
4. Asellus showed a tendency to live longer in the higher pH.

Blood Changes in Emotionally Excited Rabbits:—By L. B. NICE AND H. L. KATZ, Ohio State University, Columbus, Ohio.

A chemical analysis of the blood of quiet and excited rabbits was undertaken to determine the contributing factors in the specific gravity increase of excited blood.

The blood samples were taken directly from the heart of 24-hour-fasting rabbits. Excitation was produced by stimulation with Faradic currents for a period of about five minutes by means of a Harvard inductorium. The excited sample was drawn approximately 10 minutes after the excitatory period.

The constituents analyzed were: sugar, non-protein nitrogen, urea nitrogen, preformed creatinine, total creatinine, and uric acid (Folin-Wu); calcium (Roe-Kahn), inorganic phosphorus (Youngburg and Youngburg), chloride (Whitehorn), cholesterol (Day and Bollinger), hemoglobin (Newcomer).

The results on ten normal rabbits average as follows: Sugar, 18% increase; non-protein nitrogen, 16.4% increase; urea, 18.3% increase; preformed creatinine, 25% increase; total creatinine, 10.1% increase; uric acid, 51% increase; inorganic phosphorus, 22.2% decrease; calcium, no change; chloride (as NaCl) 6.3% increase; cholesterol, 12.2% increase; hemoglobin, 6.3% increase.

The results indicate that (1) practically all of the common blood constituents (with the exception of calcium and phosphorus) contribute to the specific gravity increase of blood of excited rabbits; and (2) there is a great catabolic action upon protein metabolism as well as carbohydrate metabolism during emotional excitement.

The Behavior and Autopsy Findings in a Case of Cerebellar Agenesis in a Dog:—By GRANT O. GRAVES, Ohio State University, Columbus, Ohio; introduced by Dr. F. L. Landacre.

A seven months old dog, of a normal litter, was described which presented asynergic movements on land (atonia, asthenia, ataxia and hypermetria) and synergic movements in the water (normal swimming). Motion pictures were shown to illustrate the attempts to rise, to walk and to swim. Autopsy photographs were shown illustrating the absence of the vermis and the diminutive cerebellar hemispheres. The relative distribution of the pyramidal tract to the segments of the spinal cord was suggested as a possible explanation for the strength of the neck and trunk and weakness of both extremities, when the cerebellum is not present and the remaining physiological levels are functioning.

E. THE SECTION OF PSYCHOLOGY.

PROF. HORACE B. ENGLISH, Ohio State University, Columbus, Ohio,
Vice-President.

(Abstracts not submitted.)

F. THE SECTION OF THE PHYSICAL SCIENCES.

PROF. FORREST G. TUCKER, Oberlin College, Oberlin, Ohio,
Vice-President.

Final Revision of the Crystal Structures Present in Certain Chromium-Nickel Alloys:—By JAMES O. LORD AND F. C. BLAKE, Ohio State University, Columbus, Ohio.

When chromium is dissolved in nickel the nickel lattice is distorted from a face centered cube of edge 3.516 ängstroms to one of edge 3.603 angstroms at a weight per cent of chromium of sixty, the amount of the distortion being 2.5 per cent.

When nickel is dissolved in chromium the body-centered lattice is slightly reduced in size, but not more than 12 weight per cent of nickel is soluble. For alloys richer in chromium than sixty per cent, new phases show up and by proper etching with a twenty per cent solution of sulphuric acid and by examining the insoluble residue two new phases are sorted out, one a face-centered cubic lattice NiCr having 96 atoms to the unit cell, 48 chromium and 48 nickel, with the length of the edge 10.62 ängstroms, practically just three times that of the undistorted nickel lattice. The other phase is body-centered tetragonal Ni_2Cr with 8 atoms of nickel and four atoms of chromium, the a-edge of the tetragonal prism being 5.31 ängstroms, with the axial ratio 0.92. The space group of the new cubic lattice is T^3_h and of the tetragonal lattice C^5_{4h}.

In the micro-photographs of these alloys rich in chromium only three phases could be clearly distinguished, though one of the three showed lines or striations through it in such a way as to make it possible to say that it was really two phases.

The possibility of a fifth phase, chromium nitride, being present in certain melts was discussed.

An Exact Determination of the Ratio of the Edges of the Unit Lattices of Calcite and Rock Salt:—By F. C. BLAKE AND E. W. FORD, Ohio State University, Columbus, Ohio.

A large number of powder photographs of rock salt and calcite with three cameras of radii 11.3, 16.5, 30.5 cms. were taken, the rock salt and calcite being kept separate in one series of measurements and intimately mixed in the other series. For proper determination of the Miller indices of the faces of the 46° rhomb of calcite rotating crystal photographs of calcite were taken.

Attempts were made to weight the a-values according to the intensity and sharpness of the lines on the powder photographs.

Taking the edge of the rock-salt cube as 5.62800 ängstroms, that of the calcite rhomb was found to be 6.3584 ± 0.0003 in the first series of measurements and in the series intimately mixed it came out 6.3598 ± 0.0006. A critical discussion of correction factors was presented. No correction factors were used in the series where the two powders were intimately mixed. This indicated that there is a small systematic source of error in the method of applying correction factors which is being given further attention.

Laue Photographs of Piezoelectrically Oscillating Quartz Crystals:—By CARL E. HOWE, Oberlin College, Oberlin, Ohio.

Laue spots from piezoelectrically oscillating quartz crystals have a fine structure, indicating increased reflecting power from point to point within the crystal, and caused by inhomogeneous strains present. Using a point focal spot and collimating slits large enough to cover the entire width (28 mm.) of a crystal, Laue "slit" photographs have been made, revealing the inhomogenous strains present in that particular cross-section of the crystal. For cases of simple resonance modes of vibration there is a one to one correspondence between the strains thus revealed and the lycopodium powder diagram of the same mode of vibration.

The Use of the F. P.–54 Pliotron in the Measurement of X-Ray Absorption Coefficients.—J. E. EDWARDS, Ohio University, Athens, Ohio.

The F. P.–54 Pliotron Vacuum tube has been used successfully in amplifying and measuring ionization currents on an X-ray spectrometer in connection with the measurement of absorption coefficients. Extreme precautions in shielding were necessary, the tube being mounted on the spectrometer arm with the ionization chamber. Absorption coefficients of Al and Cu measured from .25 A to .6 A were in agreement with the data of Allen and Richtmyer.

Radiation Attending Low Critical Potentials in Hg and An Electro-Static Method of Narrowing Electron Velocity Distribution:—By E. N. SHAWHAN, Ohio Wesleyan University, Delaware, Ohio.

A search was made for possible radiation corresponding to critical potentials below 4.66 volts found by Professor Jarvis and verified by Pavlov and Sueva. The three-element type tube was used with the grid and plate connected. The ultra-violet and visible regions were photographed with a Hilger E-3 quartz spectrograph. Using a pyrex window the red and infra-red regions were investigated with a fast glass spectrograph and with a Bausch and Lomb constant deviation spectrograph. Eastman type P and type Q plates were used. No radiation at potentials less than 4.9 volts has been found to date.

Electron velocity distribution was reduced by requiring a unidirectional beam of electrons to travel against a certain retarding field while being accelerated at right angles to their initial direction by a suitable field. An initial distribution of about 1.5 volts was reduced to less than 0.4 volts.

Stabilization of Oscillators Used to Drive Quartz Crystals:—By D. W. BOWLAND, Oberlin College, Oberlin, Ohio.

In making Laue photographs of a piezo-electrically vibrating quartz plate it was desired to drive the crystal at one of its many resonance modes of vibration, where the crystal does not have sufficient stabilizing reaction upon the driving oscillator circuit. A means was devised to synchronize the frequency of the oscillator with the resonance frequency of the crystal. The deviation of the crystal current at the resonance point was recorded on a potentiometer-controller which operated a motor-driven vernier condenser in the oscillator circuit. The frequencies were synchronized to within fifty parts in a million without temperature control.

Heat of Vaporization and Charles' Law Apparatus for First Year College Physics:—By C. W. JARVIS, Ohio Wesleyan University, Delaware, Ohio.

1. Apparatus for heat of vaporization was described in which the Bertholet design was modified by adding a super-heating coil and a new design of steam trap, eliminating loss by evaporation. Results within 5 calories of the accepted value are readily obtained.

2. A Charles' Law apparatus was shown by lantern slide, having the following features:

(1) All glass parts in contact with mercury, insuring long life without recleaning.
(2) Small amount of mercury used.
(3) Self-draining air chamber.
(4) Sensitive control for adjustment of air to constant volume.
(5) Capillary correction eliminated for pressure measurement.

A Simple Curved Mica X-Ray Spectrograph:—By J. F. HAINES, Oberlin College, Oberlin, Ohio.

A wood cylinder of 2 cm. radius about which is bent a strip of mica .036 mm. thick is mounted with its axis parallel to the slit system. The rays from a Mo tube come through the lead slits, fall on the mica at grazing angle, and after reflection strike two parallel plates so mounted that half the beam falls on the first plate and half on the second, 56 mm. behind it. This gives a simple and accurate means of measuring $\tan 2\theta$, and hence $\sin \theta$ to be used in Bragg's equation, $\lambda = \frac{2d \sin \theta}{N}$.

Fifth order spectra showing α_1, α_2, β, and γ, lines of the K series can be obtained in about two and one-half hours, running the tube at 27 KV and 18 milli-amps.

Values of λ measured by this method are found to be accurate to well within one percent.

The Use of the Milling Machine as a Precision Optical Bench:—By J. J. JOHNSON AND C. W. JARVIS, Ohio Wesleyan University, Delaware, Ohio.

A milling machine, because of its many adjustments and accurately controlled and measured motions, was found to serve admirably as a

base for an optical bench upon which measurements of considerable precision may be made. A wooden extension arm carrying the light source and collimator was fastened to one end of the bed of the machine in a manner such that it might be removed easily when the machine was needed for other purposes. The lens system to be tested was placed near the center of the bed.

Focal lengths may be determined readily by the modification of the general magnification method which calls for a measured change in the object distance, as this distance can be measured very accurately by the longitudinal screw-motion of the bench.

When the machine is used as a nodal slide, the light source must of course be mounted independently of the rotating bed. The image screen is suspended by clamps from the upper axle.

The bench was found to be ideal for measurement of short focal lengths by displacement; for nodal slide work and the determination of cardinal points; for focal lengths by magnification methods; and for aberration work.

The Raman Spectra of a Series of Organic Chlorides:—By R. R. HAUN, Ashland College, Ashland, Ohio.

When light from some intense source, preferably monochromatic or containing as few frequencies as possible, is passed into various substances, the light scattered by the substance is found, on analysis with the spectrograph, to contain additional frequencies to those present in the original source. The displacements of these frequencies from the original frequencies are characteristic of the substance and are known as the Raman spectrum of the substance.

These displaced frequencies are due to the addition or subtraction of energy from the light quantum by the molecule and consequently indicate the energy levels of the molecule under normal conditions. These energy values are assigned to the motions of the atoms with respect to each other, since the same pair of atoms always produce the same displacement in different compounds. From the energy values the force of attraction between the atoms in the molecule may be calculated.

The value for the carbon-chlorine bond is 657 cm^{-1} in all organic chlorides where the chlorine atom is attached to the carbon atom at the end of the chain of atoms, no matter how long the chain. If the chlorine atom is attached to a carbon next to the end, the value is reduced to a little more than 600 cm^{-1}. When the chlorine is attached to a carbon to which two other chains of atoms are attached, the value of the displacement is still further reduced to 564 cm^{-1}. In general one or two lower and weaker frequencies may be associated with this bond, but they are not as consistent nor nearly as strong as the fundamental.

Zeeman Effect Observations:—By RALPH A. LORING, Ohio State University, Columbus, Ohio.

The apparatus set up recently at Mendenhall Laboratory for Zeeman Effect is described. It consists of a large Weiss type water

cooled magnet having an exciting current of 114,000 ampere turns and with ferro-cobalt pole tips, the faces of which are 10 mms. in diameter. The field obtained is 40,400 gauss with a gap of about 4 mms. The spectroscopic apparatus consists of a 30,000 line per inch Wood 21 ft. concave grating set up in the Paschen Runge arrangement. The dispersion and resolving power are about 1.32 AU per mm. and 70,000 respectively in the first order. Pictures of various typical Zeeman effects are shown. Of particular interest are Pb 4798, 4761, 3854, 3689. These form an SP multiplet in the third spectrum. The coupling is J-J type.

Factors Affecting the Constancy of Frequency of the Negative Resistance Tetrode Oscillator:—By W. C. SEARS, Ohio State University, Columbus, Ohio.

Interest has recently been renewed in the Dynatron oscillator principle, since it has been found to have excellent frequency stability characteristics. Consequently, it is being widely used as a convenient variable frequency standard.

The Dynatron offers negative resistance by virtue of the secondary electrons emitted from the plate due to its bombardment by the primary electrons from the filament. A tube operating over a negative resistance characteristic will sustain oscillations when connected in parallel with a tuned circuit, if $r \leq L/RC$; where, r is the absolute value of the negative resistance; L, the inductance; R, the resistance of the tuned circuit, and C, the capacity.

Experimental data was taken and graphs plotted to show the dependence of frequency upon operating voltages. The inductance and capacity being held constant, filament, screen-grid, control-grid and plate voltages were varied separately, and the corresponding frequency change measured by the audible beat method, using a standard tuned-grid oscillator. The frequency is practically independent of operating voltages for the UX-322 tube, if the screen-grid is held at a high positive value (85 ± 2 volts), the filament at 3.3 volts (rated), the control-grid as highly negative as will sustain oscillations; under these conditions, the plate voltage is not critical. Thus, a variation of 0.1 volt in the control-grid, screen-grid and filament voltages, each results in a frequency variation of .007, .004, .005 cycles respectively. The frequency change corresponding to a 10-volt plate variation is very nearly zero. Such constancy of frequency compares quite favorably with that of a crystal controlled oscillator.

A. W. Hull developed an expression for the frequency,

$$f = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \left(\frac{R}{2L} - \frac{1}{2rC}\right)^2}$$

assuming that the negative resistance was constant; i. e., a linear negative characteristic. This is not justified as shown by static and oscillatory, Ep-Ip, characteristics—the latter exhibiting a hump symmetrically in the center. Also, the frequency changes when the negative resistance is apparently constant.

Probably, high harmonics are present and the theoretical explanation of the frequency variation is quite complex.

Dynamial Stability of the Stars:—By HERMAN ROTH, Ohio State University, Columbus, Ohio.

The final test of any stellar model is its stability. The question whether or not the star will maintain its configuration in spite of the many perturbations that are occurring constantly is of primary importance. The general condition for the dynamical stability of any state of a configuration is that the energy of the state shall be a minimum. The method generally used, is to introduce an arbitrary varied motion, constrained in a particular way and determine if the perturbation increases or decreases the energy of the state. If the energy decreases, the state is unstable. If, however, the energy increases, the state may or may not be stable. It is only stable for this particular perturbation. There may be others for which the state is unstable.

The Jacobi Condition for dynamical stability of a configuration shows the state unequivocably stable or unstable. It is not always easy to apply because it requires a complete solution of the equilibrium equations. The procedure followed in the use of this condition was explained by an application to a star considered as a slowly contracting or expanding fluid sphere.

Determination of Natural Frequency of Weight Attached to Vertical Spring:—By THEO. F. KUECHLE, Central High School, Columbus, Ohio.

A weight of "W" lbs. is attached to a spring, "S," and produces a stretch of "h" inches at the bottom end of the spring as measured from the natural or unloaded position of the spring. If the weight be pulled down another "h" inches and then released, the system will vibrate at a rate dependent entirely upon the extension "h."

The energy transformations which occur as the vibration goes through a complete cycle have been tabulated below.

Since no energy is added or lost during any given vibration, it follows that the energy is constant at all points of the vertical vibration. This gives us the value of the kinetic energy of the weight, "W" when it is passing through the center of its stroke at an unknown velocity, "V." However, knowing now that its kinetic energy is $\frac{Wh}{2}$, which equals $\frac{WV^2_m}{2g}$, where V_m is the maximum velocity of W in feet per sec., h in feet, and $g = 32.2$ feet/sec./cec.

Since the motion is harmonic a definite relation holds between the average velocity, Vav, and the maximum velocity, Vm., viz., Vav = .636 Vm, the factor .636 being obtained by averaging the values of "y" of the function $y = \sin \alpha$ during a 90° interval as limiting values of α.

Position of Spring Supported Weight	Weight		Spring		Total Energy
	Kinetic	Potential	Kinetic	Potential	
Top.....	0	2 wh	0	0	2 wh
Center.....	$?=\frac{Wh}{2}$	wh	0	wh ÷ 2	2 wh
Bottom.....	0	0	0	$2h\frac{(2W+0)}{2}=2wh$	2 wh

Evaluating the equation $\frac{Wh}{2}=\frac{W\,V^2_m}{2g}$ we have $V^2_m = gh$, or $Vav = .636\ V_m$ from which $Vav = .636\sqrt{gh}$.

In general: distance $=\begin{cases}\text{average}\\ \text{veloc.}\end{cases}\times$ time. Since it is more convenient to count only the stroke when "W" hits bottom, the distance traveled in one minute by weight W equals 4hf where f = number of complete vibrations per minute.

From the equation $\left\{\begin{array}{r}4hf = .636\sqrt{gh}\times 1\text{ minute}\times\\ \text{Distance} = \text{av. veloc.}\times\text{time}\end{array}\right\}60$

Since it is more convenient to measure "h" in inches the above reduces to $\frac{4\,h''\,f}{12}=.636\sqrt{g\,\frac{h''}{12}}\times 60$ from which $f=\frac{12\times.636}{4\,h''}\sqrt{32.2\times\frac{h''}{12}}\times 60$ which simplifies into $f=\frac{187.7}{\sqrt{h''}}$ double strokes per minute.

This equation of natural frequency holds good only if the weight of the spring is negligible compared to the weight at the bottom of the spring; otherwise the extension "h" must be increased by an amount in proportion to the stretch produced by the weight "W."

The original mathematical work preceding the experimental verification was made by me October 6th, 1925. Other vibrating mechanical systems have been investigated mathematically and experimentally with the same satisfactory results.

The entire series of investigations was inspired by the desire to give the boys of high school age an easily verified prediction and mechanical analogy of what occurs when a charged electrical condenser is placed across an inductance. The frequency of the resulting oscillations will be given by the formula $f=\frac{1}{2\pi\sqrt{LC}}$, where L = self-inductance in henries and C capacity of condenser in farads. The resistance of the oscillating circuit is neglected.

G. THE SECTION OF GEOGRAPHY.

PROF. EUGENE VAN CLEEF, Ohio State University, Columbus, Ohio,
Vice-President.

The Prairie Peninsula:—By EDGAR NELSON TRANSEAU, Ohio State University, Columbus, Ohio.

The causes of the Tall Grass Prairie and "Prairie Peninsula" continue to be debated as if the only problem involved is grassland vs. forest, and that the answer has but two alternatives: climate or soil. As a matter of fact when an adequate discussion of the prairie is published it must account for the natural geographic boundaries of certain tree species, the occurrence of prairie species and prairie colonies far distant from the main body of the prairie, the dominance of grasses on both well drained and poorly drained areas, the nature of the forests bordering the prairies, the fact that this prairie dominance is not recent but has persisted for 20 to 30 centuries, that unique types of soil "prairyerths," have developed, that there is no consistent correlation between prairies and soil types as classified by modern pedologists, and that at the time of settlement prairie occupied more than 300,000 sq. mi. of land surface stretching from Manitoba to the Gulf, and from Nebraska to Ohio.

In explaining the Tall Grass Prairies, climate cannot be dismissed by repeating the tradition that they "developed in a forest climate" when weather statistics do show difference in relative humidity and precipitation types. Growth of trees on former wet prairies is no proof that they could grow there a century ago. The post glacial history of the prairie peninsula is certainly different from that of the forested regions north, south and east.

The prairie problem is a highly complex one, and its solutions will involve a large group of contributing factors of the present and the geologically recent past.

Some Experiences in Teaching Geography by Radio:—By W. R. MCCONNELL, Miami University, Oxford, Ohio.

For the past two years I have broadcasted lessons in Geography each Thursday afternoon from Station WLW in Cincinnati. The length of time allotted to each lesson is twenty minutes.

There are difficulties in the way of getting satisfactory results. In the first place, education is achieved by self-activity and there is a tendency for pupils to remain passive during a radio lesson. This tendency is recognized and a conscious effort made to overcome it by: (1) placing an outline of the lesson together with questions and problems in the hands of the pupils; (2) making constant references to maps during the lesson.

The radio can supplement the classroom teacher; it can never be a substitute for her. A radio lesson cannot be built to fit in with the needs and capacities of each child. The adaptation of the material presented to the individuals in the class will always be the peculiar work of the teacher.

From time to time teachers have indicated definite benefits that have accrued from the radio lessons. Among the benefits listed most frequently are:

1. The habit of attentive listening.
2. Good drill in the taking of notes.
3. The power to distinguish between the facts that are important in showing human relationships and facts that are merely interesting.
4. The writing out of notes which affords a fine opportunity to correlate with English.
5. The preparation of graphs and the ability to interpret graphs.

Letters received from home listeners in many states indicate a genuine interest in geography on the part of adult America. An analysis of the comments received from adult listeners indicates a much keener interest in the story of human adjustments to the natural world than in the mere listing of facts about countries.

Notes on the Vegetation of Ireland with Special Reference to the Limiting Factors of Geographical Distribution:—By A. E. WALLER, Ohio State University, Columbus, Ohio.

A statistical study of the plant life of Ireland shows that while the majority of plants are those of England and Wales that two groups notably one from North America and one from the Mediterranean region are absent from the English flora. The peculiar local distributions of plants are the result of complex factors involving topography, moisture, evaporation, etc. Among the introduced plants certain palms, bamboos, Fuschia and other tender woody plants thrive while wheat and maize do not. The theory of limiting factors as opposed to geographical barriers is discussed in attempting to account for the peculiarities of the distributional problems.

The Influence of the Charcoal Iron Industry in Southern Ohio:—By WILBER STOUT, Ohio State University, Columbus, Ohio.

The Hanging Rock Iron District embraced an area of approximately 120 square miles with 24 charcoal furnaces in Greenup, Carter, and Boyd counties, Kentucky, and 170 square miles with 45 stacks in Lawrence, Scioto, Gallia, Jackson, Vinton, and Hocking counties, Ohio. The industry here was inaugurated with the building of Argillite Furnace in 1818, and ended with the abandonment of Jefferson in 1917. The period of greatest activity was from 1832 to 1870, during which time both furnace building and operation were vigorously prosecuted. At the time it ranked as one of the most important iron centers of the world. Both capital and labor were attracted to the region. These furnaces were rather uniformly distributed over the area from 3 to 5 miles apart as each required ore and timber holdings of 5,000 to 10,000 acres. The requirements for the operation of a charcoal furnace were 100 men and 50 yoke of oxen. The labor consisted in cutting and coaling the wood, mining the ore and limestone, smelting the stock, and hauling the iron to the place of shipment. The furnaces were a powerful factor in the development of industries in the Ohio Valley, in the promotion of trade, in the strengthening of river traffic, in the

projection of railroads into the area, and in the rapid development of the region as a whole.

Soil Development in Ohio:—By G. W. CONREY, Ohio Agricultural Experiment Station, Wooster, Ohio.

Soil development is an expression of the effect of environment under which soil material has existed. Where soils have existed in place under fairly good drainage for a sufficient length of time for the environmental conditions to be impressed there is developed in the soil a differentiation into layers or horizons with markedly different characteristics. Such a soil is a *mature* soil. Where, as a result of unfavorable conditions, such as a high water table, or of erosion, there is little differentiation into horizons, the soil can be called *immature.* Recently deposited materials, such as stream alluvium, show little or no development of horizons or layers. These are *youthful* soils.

The soils of Ohio have developed under a humid climate, and with a deciduous forest cover. The mature soils developed under these conditions have been designated grayish-brown forest soils. Differences in topography and drainage in any area have resulted in marked differences in the stage of soil development. As a result soils may range in color from brown, through grayish-brown and gray to grayish-black.

Although all of the mature soils of the state have many characteristics in common, variations in parent material are reflected in the soil derived from them, as is shown in the marked difference in the glacial limestone and glacial sandstone and shale soils. Time of development is important as is shown in the nature of the soil derived from the Late Wisconsin drift in western Ohio, and from the Illinoian drift in southwestern Ohio. Both are derived from calcareous glacial drift, but in one case the depth of leaching is from 2 to 3 feet, in the other 8 to 10 feet.

Factors Explaining Ohio's Freak Winter in 1932:—By PARIS B. STOCKDALE, Ohio State University, Columbus, Ohio.

The weather of Ohio during the early months of 1932 was history-making because of two exceptional conditions: (1) the abnormal warmth of January and February; and (2) the abnormal cold of March, especially the first half when a phenomenal, prolonged cold wave visited the state. January was the warmest January on record, with an average state temperature for the month 12.1 degrees above normal. The next month was the warmest February on record, excepting 1890 and 1930. The departure from the normal temperature was plus 8.8 degrees. Winds from the south and southwest prevailed. North and northwest winds were scarce. For the whole month of March the temperature for the state averaged 4.9 degrees below normal. During the first half of the month the departure was much greater. During the prolonged cold wave, which lasted ten consecutive days between March 6 and 10, inclusive, the minimum daily temperatures were lower than during all of the preceding days of the winter, with few exceptions. At Columbus, during the cold wave, minimum daily

temperatures ranged between 5 and 20 degrees above zero. During the months of December, January, and February, there were but two days with lowest temperature below 20 degrees, at Columbus. Conversely, there were no March days as warm as the warmest days of the earlier winter months.

The immediate explanation of Ohio's freak weather of early 1932 lies in the behavior of the anticyclones ("highs") and cyclones ("lows"). The courses of these "storms" were plotted and studied. The performance of the cyclones and anticyclones during January and February was exceptional in these respects: (1) most of the "lows" passed to the north of the state, thus causing a sweep of air from a southerly direction; (2) "highs" did not come from the cold northwest and pass within influencing distances of Ohio; instead, many "highs" came from the west and southwest and swept across the continent to the south of Ohio, thus causing a sweep of warm air across the state from the south; (3) several highs loitered over southeastern United States to aid the prolonged periods of warm weather. During the ten-day cold wave of March, the anticyclone-cyclone relationships were the reverse of those of most of the earlier winter. A cold "high" came into the United States at the northwest, carrying temperatures as low as 20 degrees below zero. This anticyclone loitered over western United States for several days and compelled a sweep of cold west and northwest winds across Ohio. No explanation is attempted for the cause of the peculiar behavior of the cyclones and anticyclones during Ohio's freak winter of 1932.

Washington's Lands in Ohio:—By GUY-HAROLD SMITH, Ohio State University, Columbus, Ohio.

George Washington owned in the State of Ohio three tracts of land located in the present Clermont and Hamilton Counties. These three areas, totaling 3,051 acres were surveyed in 1788 and title was given by the governor of Virginia in 1790. Washington acquired these lands by purchase of two military warrants from Virginia soldiers who did not care to locate in the Virginia Military District. A federal law enacted in 1790 made Washington's titles insecure but he went to his grave believing that the lands were clear, for he listed them in his will at five dollars an acre. In 1806, Joseph Kerr, knowing that the titles to the Washington lands had not been perfected made three entries covering these tracts, and the present owners hold their titles from him. Numerous attempts have been made to get Congress to reimburse the Washington estate for the loss of these lands but all efforts have failed.

Sequent Occupancy of a Village on the Ohio Till Plain:—By ALFRED J. WRIGHT, Ohio State University, Columbus, Ohio.

Typical of the many villages which characterize the densely-populated till plain in southwestern Ohio is Waynesville on the Little Miami River. During its steady growth, over a period of a century and a quarter, the utilization of the environment assumed a series of cultural patterns the examination of which is the thesis of this paper, to the end

that the qualities of relationship may be determined in so far as they pertain to the natural environment and its configuration in the immediate site.

The culmination of this series of regional economies is integration with the economic life of large centers whose major activities are attuned to the remote as well as the immediate environment.

Nationalistic Elements in Farming in Northwest Ohio:—By CARL DUDLEY VARVEL, Ohio State University, Columbus, Ohio.

The farming population in the Lake Plains of Ohio is evenly distributed so far as nationality antecedents are concerned. However, there are certain localities where the majority of the people are derived from a given stock and where, therefore, the nationalistic elements are discerned in the farming habits.

The Lake Plains on the whole are rich agricultural lands, devoted to general mixed farming with livestock and, in favored places, to specialized vegetable and fruit culture.

Among the people, those of Germanic origin are the most numerous. Yankees, other old Americans, French, Scotch, and Polish are represented in fair numbers. Those derived from other nationalisties are to be found in isolated instances. The first arrivals preempted the lands thought to be the best. However, it appears much of the best lands have passed into the hands of the people of Germanic origin. This, in the writer's opinion, is due to their superior methods of soil management, labor output and the tendency to build up the capital investment in the farms, over long periods of time. These superior methods among the Germanic groups are traceable, the writer believes, to the seemingly inherent love of the soil, evident willingness of self-sacrifice and the gratitude for economic opportunity offered for hard work to those who pioneered into these lands.

Some Elements of the Cultural Landscape on the Lake Plain of Northern Ohio:—By REUEL B. FROST, Oberlin College, Oberlin, Ohio.

The Lake Plain of Northern Ohio is generally considered that portion of the terrain between the present shores of Lake Erie and the outermost ridge, (Butternut) which marks the southern shoreline of an ancient glacial lake Maumee. There were formed on this Lake Plain at least two other continuous and well defined ridges which represent the margins of the lowering lake level at successive stands. Between the ridges or beaches the surface is monotonously flat, being broken by but few post glacial stream valleys, poorly drained, and consists of heavy clay to clay loam soils. In contrast, the ridges, although not prominent topographic features, are sufficiently high to give good drainage, and are composed of the lighter sandy, gravelly soils.

Cultural contrasts are just as striking. Instead of the roads following the surveyed lot lines, the early pioneer found the even-crested, well drained, more penetrable ridge tops the best sites for his roads. That influence has persisted down through the years until now the ridges are the modern East-west arteries of transportation and com-

munication; property lines have been adjusted to give ridge frontage; land utilization is different. There is a notable change in architectural design; and land values are greater along the ridges.

A Geographic Interpretation of Wheat Production on the Columbia Plateau:—By JOHN H. GARLAND, Ohio State University, Columbus, Ohio.

This paper is concerned with presenting a geographic study of the wheat producing area of the Columbia Plateau of Washington, Oregon, and Idaho in the following manner:

1. The importance of the Columbia Plateau in relation to other wheat producing areas of North America.
2. The location and size of the wheat producing area.
3. The importance of wheat production in relation to other activities within the area.
4. Relationships of wheat production to the complex of natural environmental factors of the area.
5. Important non-environmental factors.

Typography and its Utilization in the Fiord Portion of Central Norway:—By GEORGE D. HUBBARD, Oberlin College, Oberlin, Ohio.

Typography and its Utilization in the Fiord Portion of Central Norway.

This land of former profound glaciation is marvelously cut up by fiords whose origin has long been discussed. The truth among the theories is sought.

Preglacial stream erosion was at least a two cycle process as present forms testify. The relation of the ice remnants to this topography is shown. Man has been making much use of this part of Norway for many hundreds of years. His use of it is described and interpreted.

Influence of Physiography in the Campaign around Chancellorsville:—By KARL VER STEEG, College of Wooster, Wooster, Ohio.

The campaign around Fredericksburg and Chancellorsville is particularly interesting to the student of Geography, for the reason that it was influenced to a large degree by the topography of the region and was conducted by two of the most colorful characters of the Civil War, Stonewall Jackson and Robert E. Lee. Both were strategists of a high order who studied their territory with great care. Their movements were largely the results of earth control.

Richmond occupied a strategic position; the Blue Ridge Mountains to the west and the broad estuaries and deep valleys of a series of parallel rivers to the northwest, gave it natural defenses which played an important part in the campaigns in Virginia. The Confederate armies, having the advantage of operating on interior lines, utilized the parallel rivers as lines of defense. The Confederate generals, familiar with every foot of the region were able to put to use every natural obstacle in their campaigns.

At Chancellorsville the forest screen and rough topography were decidedly unfavorable to the Union forces who were, one might say,

penned up within the Wilderness, a region of dense forests, thickets and deep ravines. Lee and Jackson, taking advantage of Hooker's dilemma, divided their forces and out-manoeuvered him, forcing him to retreat.

A Phase of the Geography of Chattanooga, Tennessee:—By N. C. BURHANS.

The Downtown Mercantile Area. Constituting for the time being a culmination of a series of successive progressions from the site of Ross Landing to its present situation, the vital portion of the mercantile core represents a focus of master urban and inter-regional transport arteries. The natural basin of a small Tennessee tributary is the logical receptacle for the downtown retail district and to this matrix the urban structures have accommodated themselves. On the east and west, topographic obstacles in the form of hills hem in this basin, on the north the Tennessee itself, and on the south a cultural barrier, the railway terminal fabric. Sympathetic to the widening of the valley upstream, the cultural units have expanded from a narrow dimension at the river's edge to a wide base on Ninth Street. It is toward the south also that the vertex of the shopping area is located between Seventh and Eighth, Market and Broad Streets, where buildings rise to ten or fourteen stories. Analysis of the component elements of the downtown mercantile form reveals a vital nucleus of preferred shopping and banking territory with bulkier commodity dispensaries, light processing and public and semi-public institutions clinging with varying degrees of adhesion to this central location.

Human Embryos.

Dr. Dodds has prepared a very complete account of the development of the human embryo as it is known and understood today. The book confines itself to human embryology, and can not, therefore, be used where a comparative embryology is required. It is an exceedingly usable text, however, and is written with a clarity of expression and continuity of theme unusual in a subject as intricate as this. A very complete series of illustrations add immeasurably to the text material. Many of these illustrations are original. The last chapter, summarizing the general schedule of development, with its various possible anomalies, is exceptionally worth while.

Essentials of Human Embryology, by Gideon S. Dodds. vii + 316 pp., 182 fig. New York, John Wiley & Sons, Inc. $4.00.

Recent Advances in Botany.

This is the title of the latest addition to the "Recent Advances" Series of books on botanical subjects. This volume covers a selection of topics from several fields of botany, as the following chapter headings show: Some Theories Regarding Plant Structure, Palaeobotany, Experimental Methods in Relation to the Species Problem, Fungi-Reproduction, Fungi-Heterothallism, Fungi-Mycorrhiza, Algae-Phaeophyceae, Algae-Florideae, The Virus Diseases of Plants. The subjects chosen are timely, and their treatment is concise, yet comprehensive. Each chapter concludes with a list of pertinent references. The book will prove valuable as a reference for the botanist who wishes to keep pace with the advance of his science on its many fronts.—B. S. MEYER.

Recent Advances in Botany, by E. C. Barton-Wright. 287 pp. Philadelphia, P. Blakiston's Son & Co., Inc., 1932. $4.00.